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EDMUND RUFFIN, EDITOR AND PROPRIETOR.

A
SYSTEMATIC TREATISE
ON THE
THEORY AND PRACTICE
OF
DRAINING LAND, &c.
ACCORDING TO THE MOST APPROVED METHODS; AND ADAPTED TO THE VARIOUS SITUATIONS AND SOILS OF
ENGLAND AND SCOTLAND.

ALSO, ON SEA, RIVER, AND LAKE EMBANKMENTS; FORMATION OF PONDS, AND ARTIFICIAL PIECES OF WATER, &c. WITH

AN APPENDIX,

CONTAINING HINTS AND DIRECTIONS FOR THE CULTURE AND IMPROVEMENT OF BOG, MOSS, MOOR, AND OTHER UNPRODUCTIVE GROUND, AFTER BEING DRAINED.

THE WHOLE ILLUSTRATED BY PLANS AND SECTIONS, APPLICABLE TO THE VARIOUS SITUATIONS AND FORMS OF CONSTRUCTION.

INSCRIBED TO
THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND,

BY JOHN JOHNSTONE,
LAND-SURVEYOR.

FIRST AMERICAN EDITION, FROM THE THIRD BRITISH EDITION REVISED AND ENLARGED.

"Humidiorem agrum fossis concidi atque siccare utilissimum est."—PLIN. NAT. HIST.
"Scire tuum nihil est, nisi hoc sciat alter."—PERS. SAT. I.

PREFACE
TO THE FIRST AMERICAN EDITION.
By the Editor of the Farmers' Register.

The theory and general principles of draining land present one of the most interesting subjects to the scientific agriculturist—and, when correctly applied and put to use, is one of the most beneficial and important processes of practical husbandry. Every cultivator of the soil has need of such knowledge, and yet scarcely one in a hundred applies it correctly or carefully, or to the greatest available profit. And in a national point of view, there are losses of wealth, and of blessings better than wealth, which are as enormous as they are deplorable, in consequence of ignorance of the principles and effects of draining; and which benefits might be easily secured by the exercise of proper knowledge and proper consideration of the subject. The immense quag-mire swamps of lower Virginia and North Carolina, and of the more southern Atlantic States—the equally extensive flat *pocosin* lands, saturated, if not inundated, by the usual winter rains—the moss or peat bogs of the north—the marshes on all the tide waters—the rich cane-brakes, and periodically miry prairie lands of the west and south-west—all offer subjects strongly claiming, though in various modes, and almost totally wanting, the proper application of the principles of draining. Correct views on the subject would often teach sanguine projectors to avoid schemes of drainage, as unprofitable, and in which nearly all the zeal and money have been expended, that have yet been devoted to large works of this kind in Virginia. The labor that has been thrown away, in vain efforts to drain and cultivate tide marshes, and swamps of mere vegetable and therefore putrescent and perishable soil, if properly directed elsewhere, would have added millions to the agricultural wealth of the country.

In this first publication in America of the following treatise, and in its latest and most improved form, we hazard nothing in claiming for it the rank awarded to it in Europe, as the best work extant, on draining in general—and especially on Elkington's method, in regard to a particular and very important branch of draining. But while fully concurring in the general approbation of this work, awarded by European writers and agriculturists, and maintaining that it ought to be read by every one who desires to know the ground-work and the essential principles of draining, we are very far from recommending it as a body of directions for the most usually and extensively required operations in practice. On the contrary, Elkington's principles, and peculiar plan of draining, important to be known as they are, would be seldom applicable in practice in lower Virginia, and the more southern Atlantic states; and even the more usual and best modes of surface draining, in England, as described in this work, might be changed for the better, in many particulars, in this country, where different and cheaper filling materials may be commanded—and where the more sandy and permeable soil, and warmer sun, make draining less generally wanting on arable lands. It is probable that the latter ground of difference will not be

found, or at least not to so great extent, in the northern states. It depends on the geological structure of a country, in the nature and the inclination of its strata, whether Elkington's plan of draining, by boring, will be found frequently or generally applicable and profitable, or otherwise. But it is not only to arable and meadow lands that this plan is applicable. Under suitable circumstances, it is also used to *sink* the overflowing water in mines, which otherwise must be drawn upward at great expense, and by never-ending labor. The reader who may require further inducement to study a subject which may be at first difficult and repulsive, will do well to turn first to the end of Part III, which contains concise statements of some of the most remarkable effects produced by Elkington's operations.

In offering this work to the farmers of America, we have scrupulously avoided using a liberty very commonly taken by those who republish expensive English works, in a cheaper form, in this country—that is, of omitting portions of the matter, or the illustrations, of the original, and that without warning the reader that he is furnished with an imperfect work. Every word and every plate of the last edition will be here correctly copied, with no other changes than those in regard to references to the figures and plans—made necessary by the change of the form of publication.

EDITOR OF THE FARMERS' REGISTER.

ADVERTISEMENT

BY THE BOARD OF AGRICULTURE, PREFIXED TO THE FIRST EDITION.

The Board of Agriculture had hardly been established, before it received intelligence, from various parts of England, of the singular success with which Mr. Joseph Elkington, a Warwickshire farmer, practised the art of draining land; the publication or discovery of which was represented to be one of the greatest means of promoting the improvement of this country that could be suggested. It is unnecessary to trace the various steps taken by the Board for attaining so important an object. It may be sufficient to mentiou, that in consequence of a motion made by its President, on the 10th of June, 1795, the House of Commons voted an address, "That His Majesty would be graciously pleased to give directions for issuing to Mr. Joseph Elkington, as an inducement to discover his mode of draining, such sum as his Majesty in his wisdom shall think proper, not exceeding the sum of £1000 sterling; and to assure his Majesty that this House will make good the same to his Majesty."

Mr. Elkington's health being extremely precarious, there was a risk that the public might lose the benefit of the knowledge he had acquired, by the experience of above thirty years, in a species of improvement, which, in these kingdoms, ought to be considered as the basis of every other. To prevent so unfortunate a circumstance, the Board resolved to send Mr. John Johnstone to visit, in company with Mr. Elkington, the principal drainages he was executing, and to take drawings thereof. It is to be hoped that the following report, the result of that journey, with the annexed views and sections, will furnish the reader with very satisfactory information upon the subject of this art, and will sufficiently explain the various modes of draining land, whether practised by Mr. Elkington or others.

London, May, 1797.

PREFACE.

Though the value and rent of land has decreased very considerably since the publication of former editions of this treatise, and, on that account, both landlords and tenants have less inducement to lay out money on draining, and otherwise improving land that is at present wet and unproductive; yet *such outlay* will at all times be a *safer* speculation than any other in which money may be risked.

A rapidly increasing population must require an increased supply; and money expended in adding to the productiveness of the *soil*, can never be said to be *thrown away*, when *judiciously* laid out; which is not the case with many mercantile and other adventures, where *capital* is often lost. Since the publication of former editions, the author's practice and experience have been much extended; and those editions being now out of print, he has been solicited to publish the present, to which many additions have been made, to render it more full, accurate, and generally useful. The subject must always be an interesting one to every agriculturist, and the knowledge of it productive of the greatest advantage to every practical farmer, whether landlord or tenant. The nature and object of the work are further explained in the Introduction.

INTRODUCTION.

Of all the arts that have excited the attention, or called forth the exertions of man, none have been discovered so valuable, or so generally useful as agriculture; not only by rewarding the skill and industry of individuals, but by exalting the prosperity of a nation. It is, undoubtedly, the most ancient, and the foundation on which all other arts depend; a foundation every day becoming stronger and more respectable, by acquiring the support and encouragement of the highest personages in the United Kingdom.

Having now attained that degree of superiority which its utility as a great national object deserves, it can never fail of exciting a very general attention to its practical application, as the means by which the permanent interests of the country may be so much advanced. Agricultural pursuits, are, of all others, the most conductive to health and vigor. The study of its theory, and principles on which it is founded, enlarge the intellectual, and its practice employs, in useful exercise, the active powers of man. By much the greatest part of

this island, both with regard to soil and climate, is very favorable to agriculture, and capable of much improvement; the means of which are now almost every where at command.

It is not, however, the intention of this treatise to show what are the general improvements connected with agriculture, but to explain and describe chiefly, that branch of it which may be considered the most important, and one, on the proper performing of which, most of the others, in certain situations, depend.

The necessity and advantages of draining have long been acknowledged, though the principles and practice of it have been but imperfectly understood. Since the establishment, however, of the Board of Agriculture (in 1793), by whose means and influence, the system discovered, and so successfully practised, by the late ingenious Mr. Elkington, has been generally introduced, more has been done in a scientific and perfect manner than hitherto; and by its being now introduced into most parts of the kingdom, many thousand acres have, within the last forty years, been brought into useful culture, that otherwise might have remained in a waste and unproductive state. Indeed, the superiority of this system, when conducted on the proper principles, is now so generally known and acknowledged, that there are few land-owners or intelligent farmers who are not anxious to adopt it. So sensible now are the great proprietors of land in Scotland, of their interest in having this improvement executed on a liberal and extended scale, that it is the practice with many of them, to have a general plan for the draining and subdividing the different farms, on new letting their estates. By this means, the work is executed in a more regular, substantial, and permanent manner, than it possibly could be, if left to the management or direction of the tenants themselves. On this great scale, the connection of one farm, or part of an estate, with another, renders the effect more complete, and the ultimate expense much less, than if done in small and unconnected portions; and the additional rents thereby obtained, produce a profit much greater than the same sum would do in any other mode of outlay. The tenants, too, are so sensible of the advantage of this system, that they readily give a higher rent, in preference to their having the work to do at their own expense, and in their own manner. The Highland (and now also) Agricultural Society of Scotland, have, by their liberal encouragement in giving premiums for essays, and for the greatest extent of drains executed in a successful manner, been the means of promoting the best system of that science, as well as every other branch of rural economy.

To the indefatigable exertions of Sir John Sinclair, when President of the Board of Agriculture, the country is much indebted for the many publications on agricultural subjects, particularly for that wherein the various modes of husbandry practised in Scotland, are so minutely described, and the merits of draining so clearly set forth.

The many farming clubs and societies now constituted in this part of the island, have, by their rules and premiums, contributed much to the circulation of agricultural knowledge, and to the removal of many obstacles and prejudices, both among their respective members, and the community at large.

The extension of its knowledge was likewise greatly promoted by the persuasive and perspicuous lectures of the *late* Professor of Agriculture in the University of Edinburgh.*

To particularize every individual who has used extraordinary exertions in promoting the practice of draining, would exceed the limits of this treatise, and might be offensive to some, and disagreeable to others; it will therefore be better to mention, in general, some of those counties, and extensive estates, where the greatest works have been executed, and where the various branches of it have been conducted on a large scale, and with complete success. These will accordingly be noticed in the sequel.

In dividing the subject into parts and sections, it appears eligible to adopt the following arrangement:†—

First. To give an account of the various methods in practice before the introduction of Elkington's system; stating the imperfection of these, which, though injudicious, and therefore productive of little good, are, in many places, still prevalent.

Secondly. To enter at large into the principles, and to give a full description of the manner of draining the various kinds of wet ground, according to the approved system of boring, tapping, and cutting *much deeper* than what is practised according to the *old* method.

Thirdly. To state the various modes of forming and filling drains; the general expense of executing, and manner of forming contracts for the work; with the obstacles which sometimes occur to prevent its general extension, and the probable means of lessening or removing them.

This latter section is applicable to both the preceding ones.

The whole is illustrated by explanatory plates; for without the aid of such, it would be impossible to convey a just idea of the nature and principles on which any system of draining is founded. Such plans, therefore, are given of the various situations, and sections representing the inclination of those internal strata that produce springs and wetness, as will be useful in facilitating the knowledge of this important art.

Fourthly. There is given a description of the different modes of hollow and of surface-draining, as more especially practised in the southern counties of England: and, *lastly*,

An appendix, in which are given practical directions for the culture and improvement of bog, moss, moor, and other unproductive ground, after being drained.

As the former editions of this work were written under circumstances not so favorable to perspecuity and detail, it is now offered to the review of the public, with such corrections and additions, as the writer's extensive practice and experience have enabled him to make, and which, he hopes, will render it more useful. The plates have been revised, and for the sake of further elucidation, several new ones have been added, and the whole now arranged in a better manner.

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* In almost all the agricultural publications and encyclopædias, from the time of the first edition of this treatise, the article "*draining*" has been chiefly taken from it, with *due* acknowledgment.

† The subject being closely connected with *cutting*, *section* is used as a better *division* than chapter.

To the Highland and Agricultural Society of Scotland, it is now dedicated, as a mark of the author's high respect for that useful body; and if, through its means by such influence, a desire to prosecute the improvement this treatise recommends shall be excited, he will feel a satisfaction in having, in some degree, contributed to establish so important an object; hoping that the knowledge of it will be thus so much extended, as to render the practice of it general, in every situation where it may be applied with advantage.

When he has ventured to propose any thing *new*, or that does not strictly come within the bounds of Mr. Elkington's practice, he has done so, not with a view of *preferring his own*, but from a desire of giving hints that may be useful to others. The observations he has ventured to impress, with regard to the importance of the object he is describing, and the *real* advantages to be derived from Mr. Elkington's mode of draining, he has endeavored to establish, by authentic quotations from the agricultural reports of those counties in England, where these advantages are taken notice of in detail, and from other satisfactory sources of information.

It cannot be expected that he is to enter into a learned disquisition on the nature of springs, a physical inquiry into the cause and formation of bogs, or into a chemical examination of the qualities of soil. These are the researches that would exceed the limits of this treatise; but as they are, in some degree, connected with the subject, he will confine himself to a brief statement of simple facts, so as to explain the principles of the art; and will endeavor to convey their meaning in the best language the nature of the subject admits of.

The origin of the discovery of this system, he has thought proper to explain; which, though immaterial in other respects, formed the subject of much controversy at the time when the reward (£1000) was voted by parliament to Mr. Elkington.

When it comes into the hands of those intelligent individuals who have seen, and are acquainted with the nature and method of the system it describes, the writer hopes they will pass over any imperfections this treatise may contain, and will not hesitate to correct its errors, or to supply its defects. In a georgical work of this kind, provincial terms are unavoidable, because they are those commonly applied; but to such, he has added an explanation, which makes their meaning generally understood.

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The subject of embanking is so nearly connected with that of draining, that the writer (having also experience on that *head**) has thought it proper to include, in this volume, a treatise giving a practical description of all that relates to the principles, and secure construction, of such safeguards against the encroachment of these excellent servants, but obstinate masters—the sea, lakes and rivers.

* An embankment is often termed a "head," as it makes head, or resistance, against the encroachment of high tides, or river floods.

PART I.

ACCOUNT OF THE VARIOUS METHODS OF DRAINING, BEFORE THE INTRODUCTION OF ELKINGTON'S SYSTEM.

SECTION I.

Of the benefit derived from draining in general.

That the knowledge and utility of draining is almost as ancient as that of agriculture itself, appears from the Roman writers, "De re rustica," for it is mentioned as early as the times of Cato, Palladius, Columella, and Pliny,* who mention it particularly, and describe some circumstances in the modes of draining at that time, that were lately considered as modern improvements.

From the description given by these writers, it is evident that they were sensible of the advantages, and were acquainted with various methods of constructing drains (fossæ) both open and covered; and that our British agriculturists had little to boast of in that science till the discovery by Elkington, with whose system they were wholly unacquainted. Of all the improvements by which the value of land is advanced, to the equal benefit of the owner, the occupier, and of the community at large, there are none from which so many advantages have been, and may be, derived at a moderate expense, as that of draining when skilfully applied. In the first instance, the owner is benefited by the increase of rent, the occupier by that of the produce, and the community by a greater supply of useful commodities, and by its affording a source of employment to many individuals in the lower ranks of life. The climate is rendered more healthy and genial to both animal and vegetable life, by the removal of stagnant water, and the prevention of those noxious exhalations arising from large tracts of moss and marshy ground, where the herbage gives little nourishment, and only promotes disease.

Since the introduction of draining into this country, the health of the inhabitants has been greatly improved; agues and other distempers being now comparatively unknown, that were formerly so frequent, occasioned by the humidity of the soil, and consequent impurity of the atmosphere, producing that miasma which so often proves fatal.

The pastures that have been laid dry, maintain a larger stock of cattle and sheep than formerly, superior in size and quality, and less subject to disease. The rot, that destructive malady, is unknown in *dry* pastures; for wetness alone is the cause that produces it; and as no *cure* has hitherto been found, draining is the only *preventive*. The produce of the harvest, formerly precarious on such land, becomes, by draining, ample and productive in quantity, and the quality of the grain is improved also. If land that is in tillage remains wet, every manure that is applied to it loses its effect to a certain extent, and fails to produce that abundant crop, which a less quantity would yield, if such land were laid dry.

In wet land, seasons of tillage are lost, the labor is greater, and the return less. The seed is, in many cases, nearly lost; the produce is always scanty and inferior in quality; but when land is

* Pliny, in his Natural History, says, "It is very advantageous to cut, and make wet land dry, by means of ditches," (drains.)

properly drained, every exertion of good husbandry is attended with success; and the farmer thrives where his predecessor was ruined!

Arable land is fit for tillage earlier in spring, and later in autumn; it is easier managed, and kept clean at less expense, than when chilled with water, and only in very dry seasons accessible to the plough. Its effects on grass land are no less remarkable. By draining alone, it is wonderful to see the verdure that soon takes place; and it is worthy of remark, that a bog of the worst kind, after being thoroughly laid dry (without any other melioration whatever,) will spontaneously produce so many new and fine grasses, the seeds and roots of which have hitherto lain dormant owing to superfluous moisture; but now spring forth, and afterwards continue to flourish and increase! The rushes, that formerly occupied the whole surface, soon decline, and better grasses rise in abundance. The advantages also of draining the bogs, mosses, and other tracts of swampy ground which are met with in so many even of the fertile districts of the country, are of great importance in other respects. Besides the benefit that is actually derived from the drainage of such land that is afterwards converted into a state of cultivation, a great deal might be done in contributing to the improvement of the climate and surrounding soils of the districts in which they are situated. By large open drains, these pestilential morasses might be freed of stagnant water, the extraction of which would not only render them dry, and productive of better herbage; but would afford an acquisition to many streams that have a scanty supply of water for various kinds of machinery that are, or might be, erected upon them. For inland navigation, too, a more abundant and permanent supply might be procured by this means.

The great extent of these bogs or mosses, many of their boundaries and divisions ill defined or disputed, and the want of co-operation among the several proprietors, prevent individuals, who have both the spirit and the means, from engaging in so troublesome, but otherwise not expensive undertaking; for *one main drain*, properly conducted, would lay dry a very great extent of such ground.

This is a branch of the subject that would not be unworthy the consideration of the legislature,* and well deserves the attention of the society above mentioned, as will be further noticed in the sequel.

Trees grow readily in such low situations, when the noxious water is removed, and would in time yield profit, where the cultivation of corn or pasture would be more hazardous. In grazing countries, the benefit of this would be much felt in meliorating the condition of stock, by the shelter which such plantations afford. It is perhaps a longer period to look forward to, than may arrive within the lifetime of the person who plants; but it is a certain fact, that tracts of moorish and swampy ground, planted when but imperfectly drained, have been (when the trees have come to maturity and were cut down) converted into good arable land, with the aid of only a slight additional drainage. This, the writer, in several instances, has seen during the course of his employment.

* Commissioners and surveyors were appointed, and many thousand pounds paid by government, some years ago, for drainage-surveys of the bogs in Ireland.

The merits of fiorin grass (*agrostis stolonifera*) being now so well known, is an additional inducement to the drainage of even the most steril kinds of moss and moorish soils; for in these it thrives better than any other species of grass, and is known to yield a very abundant and profitable return.

The draining of one large tract of land may furnish water for the accommodation of another; which, if collected in sufficient quantities, may be converted to its improvement by irrigation. By the same means, a more abundant and regular supply of water may be obtained for mills and other machinery; for supplying houses, ponds, inclosures, &c. Drainage may also be applied with great advantage in the case of mines and quarries, by diminishing the quantity of water found in them, both by cutting off the resources above, and by letting down that which often impedes and obstructs their workings, into more porous strata below. In short, the *benefits* that result from a general and complete system of draining, to the agricultural and general improvement of this country, are so many, that the few instances in which they are neither seen nor acknowledged, can only proceed from prejudice, or from invincible obstinacy and blindness!

SECTION II.

On the principles of draining, both of surface-water, and of that proceeding from springs.

There is no desideratum in agriculture of more importance, than a knowledge of the principles on which the draining of land depends; for without that knowledge, the practice must not only be limited, but often fail, where it would otherwise succeed. It is remarkable, therefore, that those principles should have hitherto been so little known or attended to, when improvements in the other branches of husbandry have been brought to the greatest degree of perfection. However intricate these principles may have been considered by unthinking agriculturists, they are founded on circumstances easily comprehended by an intelligent mind, and naturally point out that mode of practice, the success of which, their knowledge cannot fail to secure. To proceed with certainty in the art of draining, it is necessary to ascertain the causes which produce that wetness in land, of the different appearances, which, according to soil and situation, it assumes. It proceeds either from rain-water stagnating on the surface, where that is impervious, and has no descent; or from the water of springs issuing over, or confined under it. On clay soils, wetness is commonly produced by the first of these causes, but in a variety of cases it proceeds from the latter.

A knowledge of the causes and nature of springs, therefore, is so closely connected with the principles of draining, that it is necessary in the first place to explain these, in order to enable the practical drainer to proceed with success; for, when the wetness is produced by subjacent water, any number or kind of surface-drains can have no good effect. From the appearance of its surface, and by the internal researches that have been made by subterraneous pits, wells, quarries, and other perforations, the earth is known to be composed of various strata, which being in their nature and quality of opposite consistence, have acquired the

distinguishing names of *porous* and *impervious*. Sand, gravel, rock, and such calcareous earths as are of an absorbent quality, from their open composition, are denominated *porous*. Clay, and certain kinds of gravel, having a proportion of adhesive matter in their composition, which, binding and cementing the particles together, render them equally close and tenacious as clay itself; with such rock. as is of a solid and compact nature and without fissures, are the principal strata that resist the admission of water, and are hence termed *impervious*. It is evident, therefore, that springs must originate from water falling upon such porous and absorbent surfaces, and subsiding downwards till it is obstructed in its passage by these impenetrable substances; it there forms reservoirs of considerable magnitude, which afterwards issue out in all those different appearances which are so often met with. This is evident, from the observation, that rain falling on some parts of the ground suddenly disappears, while it remains stagnant on other still carried off by evaporation; and from the issue of springs being stronger in wet than in dry seasons. Hence, after long continued rains, they burst out in higher situations, and, as the weather becomes drier, give over running out, unless at their lowest outlets. The strength of springs also, depends on the extent of high ground that receives and retains the rain-water, which forms large reservoirs, and affords a more regular supply. Thus, bog springs, or those that rise in valleys and low situations, have a more copious and regular discharge, than those which break out on high ground, either on the sides, or near the summits of hills. Abundant springs are never met with in countries that are deeply covered with sand, nor in those where the soil consists of clay to a great depth. From the former cause, such is the case in the sandy deserts of Arabia, and in the plains of Lybia; and from the predominant depth of clay in the carses of Gowrie, Stirling, Clackmannan, and others, springs are scarce, wells are often sunk to a great depth, and the water of an impure quality. Independent of the causes that have been stated, as producing springs, there are certainly other receptacles of water in the bowels of the earth, to supply the many streams and rivers that flow through it, the rains and dews that descend being inadequate to that purpose: but, as inquiry into the nature of these would go beyond the depth of this subject, what has already been explained may suffice for the present.

A frequent cause of wetness is the stagnation of water in the ditches that surround fields, particularly in such as lie along the upper side of the inclosure, where the water, being confined, finds its way downwards into the open parts of the subsoil, and oozes out to the surface, forming, in wet weather, all the appearance of, and producing nearly the same effect, as a natural spring. This frequently happens where water is conveyed in an open drain, or *lead*, or confined in a dam,* the land lying adjacent to it, and lower, being always more or less wet by that means. The remedy in these cases, is simply the removal, or lowering of the stagnant water, by giving more depth and declivity to the ditch or hollow in which it is conveyed or confined; and, if in a lead, by making a cut on the lower side, to intercept any water that may ooze therefrom.

Lakes, lochs, and stagnant water in hollows, are often the cause of springs, and of wetness in ground at a considerable distance from them; and where such are neither objects of pleasure nor use, they ought to be drained. This will be further treated of, in the section allotted to that part of the subject.

* *Dam* is the name used in Scotland for what is called, in the south, *lead* or *race*. Here, it means an artificial lake, pond, or collection of stagnant water.

SECTION III.

Of the various soils that require draining, whether injured by surface-water, or by that of springs.

To enumerate all the various soils that require draining, would be to mention every species of earth composing the upper stratum of land; as every kind of soil is more or less liable to be wet from particular circumstances in its formation, when it comes in contact with water, either from the clouds, or from the different kinds of springs, or subjacent water by which it may be affected.

It is the object, however, of the present inquiry, to describe only those that are most subject to injury; and to explain shortly their nature and texture, so far as that knowledge is useful in guiding the application of the proper drains which they require.

The particles of the various natural bodies that are met with, being reduced by the successive influence of the atmosphere, and agency of other causes; and being mixed together in different ways and proportions according to these operations, constitute the compounds that form the bases of soils in general; while the materials of numerous animal and vegetable substances, united with such, compose the superficial mould, from which plants in general derive their nourishment and support. Thus, soils vary much in their composition, according to the qualities and proportions, both of the natural and artificial ingredients of which they are formed, and also, according to the favorable situation in which they may be placed. The impregnation of different matters, proceeding from bodies considerably below the surface, has likewise great influence in varying the properties of soils, where no external appearances are perceptible by which their qualities can be ascertained. Thus, soils apparently dry and of good quality, that lie at a considerable height above water, are often so affected by its influence, as to be kept cold and moist, and, although they may have been drained to a considerable depth below the surface, still remain in a great measure unproductive. To these the system of *tapping* particularly applies.

Soils also, that exhibit every appearance of fertility from the nature of their composition, are often so deficient in depth, and deposited on beds of cold and wet clay, rock, or watery gravel, that they are by no means so favorable to vegetation, as others of an inferior quality, but thicker, and, lying on a dry and kindly subsoil, are rendered more fruitful and productive. The superficial appearance of soils, and the natural plants which they produce, may, in many instances, ascertain their quality and texture; but it is by chemical analysis alone that these can with certainty be known. This mode, however, can only be put in trial, by those acquainted with chemistry; and as most practical farmers are not conversant in that science, and consider such experiments tedious and expen-

sive, their only mode of deciding on the nature and merit of soils, is by the requisite application of manure, and their judgment of the quality is formed by the quantity of produce.

Soils are described under numerous classes, and distinguished by a useless variety of terms; but as much as is necessary for the present purpose, may be arranged under the following heads, being those most subjected to injury from water.

Clays.—These are of different kinds, and vary both in their color and texture. They are found in their natural state, of the colors red, white, blue, and yellow. They all possess more or less of the heavy and adhesive qualities, and this depends, in a great measure, more on their contiguity or distance from the water of springs that may be lodged under them, than from any quantity of rain that may partially fall upon their surface. The latter is soon counteracted by exhalation; but the removal of the other, can only be affected by means of *under* draining.

Clays of every description are retentive of water; and in many situations require the aid of surface-drains, to relieve them from *superincumbent* moisture, even after that of springs may have been effectually extracted from under them. The blue and the yellow clays are the most pure, ductile, and tenacious; the red or brown, when freed from water, and meliorated by culture, become the most friable, and consequently the most productive of any. In the fertile districts of the carses of Gowrie, Falkirk, Stirling, Clackmannan, and other parts of Scotland, these strong clay soils predominate; but such have been the improvements in those places, by draining and other approved modes of husbandry, that the nature of the soil, in many parts of them, partakes at this time more of a rich and deep loam, than that of clay.

Such clays as are distinguished in Scotland by the appellation of *till*, are the most barren, obdurate, and unproductive. In this kind of clay, there is always a mixture both of large and small stones, which render it more difficult to excavate, and are the means of its receiving, and retaining moisture, in a greater proportion than any of the others. It is on that account more *spouty*,* and difficult to cure. Its quality too, when laid dry, is so inferior, that its produce, when cultivated, seldoms repays the outlay. The flat moors, and even the declivities of many hills in Scotland, consist of this pernicious *till*, particularly in northern exposures, and where the adjoining land, exposed to the south, is often of a light, dry, and kindly soil. The natural sterility of this kind of clay, where it has little or no covering of any other soil, is always apparent, either from its total want of herbage, or from the poverty and scantiness of the plants it produces. The only object, therefore, in draining it, is to relieve the better soil adjoining, from the effects of its wetness; and, in pastures, to render it by that means, less injurious to the stock that may at times feed upon it.

Loams.—These may be considered the most manageable, useful, and productive of all soils. They are compounded of different materials; but the substances that contribute most to the formation of loams, are clay, sand, gravel, and vegetable mould; and as these predominate, they have acquired their distinguishing names accordingly. In proportion as the argillaceous or clayey part exists in the soil, the nearer it approaches to that substance, and hence it is denominated *clayey loam*. The difference in the lightness and friability of soils of this class depends on the relative proportions of the other ingredients; and where the proportion of these lighter substances prevails, hence they are distinguished by the names of *sandy* or *gravelly loams*. It would appear, therefore, that the proper admixture of these ingredients must constitute the excellence of this soil, and must render it more pulverizable and prolific, than when one or other of the different ingredients predominates. When allowed to rest, loam acquires a degree of cohesion, little inferior to clay; and although it absorbs water freely, and swells with it, it retains only a proper quantity of moisture for the purposes of supporting vegetation, and allows the superfluity to run off where there is a descent; or yields it readily to drains that may be necessary to draw it off. With regard to the color of loams, it varies, from the application of the means used for their improvement, by cultivation and manure.

In situations where it has undergone little change by these artificial additions, the color is generally a light brown, or hazel; but where much culture has been bestowed, and large and frequent manurings applied, particularly in the vicinity of towns, the texture is altered, and the color approaches to that of black. Considerable tracts of natural loam are found in many parts of the kingdom, particularly on the sides of rivers, and as they are often, in these situations, injured both by floods and other water, it becomes an object of importance to remedy these defects, by proper drains and embankments.

Sandy and Gravelly soils.—These differ considerably from each other in respect of color, and in the nature of their consistence, and other qualities; but they may not improperly be classed under the same head. Sands are of various colors—brown, red, white, and yellow. In an agricultural point of view, however, it may only be necessary to notice the two first. The difference of color, weight, and quality, depends on the nature and quantity of other substances, with which they may be combined. These ingredients may be clay, loam, or other earthy substances, and according to the quantity of each, sands are either heavy or light in proportion. Those of the first description, where clay is the most prevalent, approach nearest to loam, and are, although more tenacious of moisture, the most valuable on that account. Such as are chiefly sand, and with less mixture of clay or vegetable mould, are too light, insipid, easily saturated with water, and seldom very productive. They are also, as well as the light gravelly soils, apt to be scorched in hot seasons, which is not the case with soils of a more retentive quality. They absorb water greedily, though they do not retain it long; it soon filtrates through them to the nearest declivity, which renders their drainage an operation of easy and certain effect.

Gravelly soils partake nearly of the same qualities as those that are sandy; but the particles that compose them being larger in the first, there must be a less proportion of animal, vegetable, and earthy substances intermixed, consequently a greater deficiency of the nutritive qualities, than in

*In England, this may be called spongy. In Scotland it means, where there is a small oozing-out of water, but no permanent spring.

the latter. They are equally absorbent of water, and easily drained; and where this is done, with proper cultivation, they acquire considerable fertility. This soil frequently abounds in Scotland, which is in a great measure the means of the turnip husbandry being now so prevalent, and brought to such a state of perfection.

Peaty and Moorish soils.—These cover extensive tracts in Scotland, where they are commonly called mosses, and in Ireland, bogs. They differ, like all other kinds of soil, by the nature of the ingredients that form their composition, the proportion of these that prevail, and from the nature and influence of the water with which in every situation they abound. In different localities, the moss or peaty substance is found of different depths, and of various degrees of consistence, proceeding from the difference of the original aquatic productions of which it has been formed, and to its later or more remote date of decomposition and decay. Under most of the deep mosses in Scotland, the substratum is clay, of a blue color, and of a tough, heavy, and spongy texture, which renders draining, where it is necessary to go through this clay, a very arduous undertaking, both on account of the difficulty of excavating and throwing out such stuff, and its being apt to spew up from both bottom and sides, impeding the work, and sometimes choking the drain. The remedy, however, will be noticed in its proper place. The different layers of moss or peat earth are observed to lie in a regular stratified order, and are more or less compact as they approach the surface. Next the bottom, they exhibit the appearance of a solid dark-colored earth, which most probably formed the original soil or surface of the ground, before the accumulation of the superincumbent moss. Above this, to a considerable thickness, the peat, though compact, is of a less solid consistence, partakes of a mixture of loam or earthy particles, and appears in a less state of decomposition. The uppermost stratum is always of a loose, soft, and spongy texture, from the aquatic plants, leaves, and other vegetable substances, of which it is composed, not being in so complete a stage of decay as the lower strata have attained.

From these observations it appears, that all peaty soils are formed by the *gradual* decay of vegetable matter, produced by the dissolution of aquatic plants, that grow in low wet situations, and by other substances brought down by water from the higher grounds, and deposited in a state of stagnation, where obstructions have impeded their farther progress. In other situations, there are peaty soils of less thickness, also formed by length of time, from the decay of coarse grasses, heath, and other plants of that kind, and where the under-soil is tolerably good, and at no great depth from the surface. These are more properly called moorish soils, and are more easily drained, and made accessible to the plough, and other means of cultivation, than deeper mosses or bogs. Besides these soils that have been described, there is a variety to be met with, composed of a mixture of all the others; particularly in the *fens*, *downs*, and *chalky districts* of England; but all require the same mode of draining and cultivation to render them more productive.

SECTION IV.

Of draining bogs according to the old method.

It has been stated in the introduction, that although the mode of draining practised by the late Mr. Elkington applies particularly to bogs, especially those that are injured by springs; yet in some places, it is still the custom to drain them according to the old method, as described in this section, and the plan, No. I, explanatory thereof. From the favorable situation of bogs, their being often of great extent, and their giving interruption to the improvement and regular cultivation of many estates and farms, their drainage becomes an object of the first attention. As their wetness, in almost all cases, proceeds from the water of springs, either confined under them, or oozing over their surface, the first thing is to consider the means by which this may be removed, by drains in a proper direction, and of no greater number than is necessary to effect the cure. This, however, has not been the method in general practice; and many unnecessary cuts are made, which otherwise might be saved. A mistaken notion prevails with many drainers, that too many cuts cannot be made; and that, besides making drains to lead off the principal springs, it is requisite to have others, to carry off *all* the appearances of water that may be seen on the surface. The error of this is, making the principal drain neither in the proper direction, nor of the requisite depth; of course, its effect is partial, and in many cases useless. There is also a general mistake in supposing that the water is to be let down from the surface into the drain, and that in this case the depth may be less; but the materials with which it is filled must nearly reach the top. Most bogs are situated near the sides of rivers, burns,* or smaller streams of water, and have generally a descent sufficient to allow the necessary drains to be cut to the full depth. The springs, for the most part, rise along the upper side of the bog, and discharge their water promiscuously over its surface. The common method is, to draw a number of drains from the lower side to the upper, where the springs break out, in straight lines, and parallel to one another. These drains are commonly at the distance of forty feet from each other, and when not effectual of themselves. have side branches drawn at acute angles from them, as represented in plate No. I, figs. 1 and 2. The effect of these drains is simply the lowering and carrying off the spring-water to a certain depth; often leaving, both below and above, a quantity sufficient to render the drainage imperfect and deficient. The mode of filling them, either with stone or brushwood, is also defective; and, consequently, in a few years they require to be renewed. The expense of these operations, from the great length of cutting, and waste of materials in filling, is very considerable, and much surpasses the profit. It therefore becomes an object of serious consideration, before engaging in a work that is so doubtful of success. This much may suffice on the subject of large and regular tracts of bog.

In the smaller ones, that so often interrupt the regular cultivation and improvement of many fields, drains, guided by the same mistaken principle, and equally inefficient, are applied in the same

* Brooks, in England.

Draining bogs according to the old method.

PLATE I. *Fig.* 1.

A A A Dry Porous ground.
C C C Sloping dry ground.
s s s Springs breaking out at bottom of sloping ground.
B B B Boggy land.
d d d Drains.
D D D Brook or ditch.

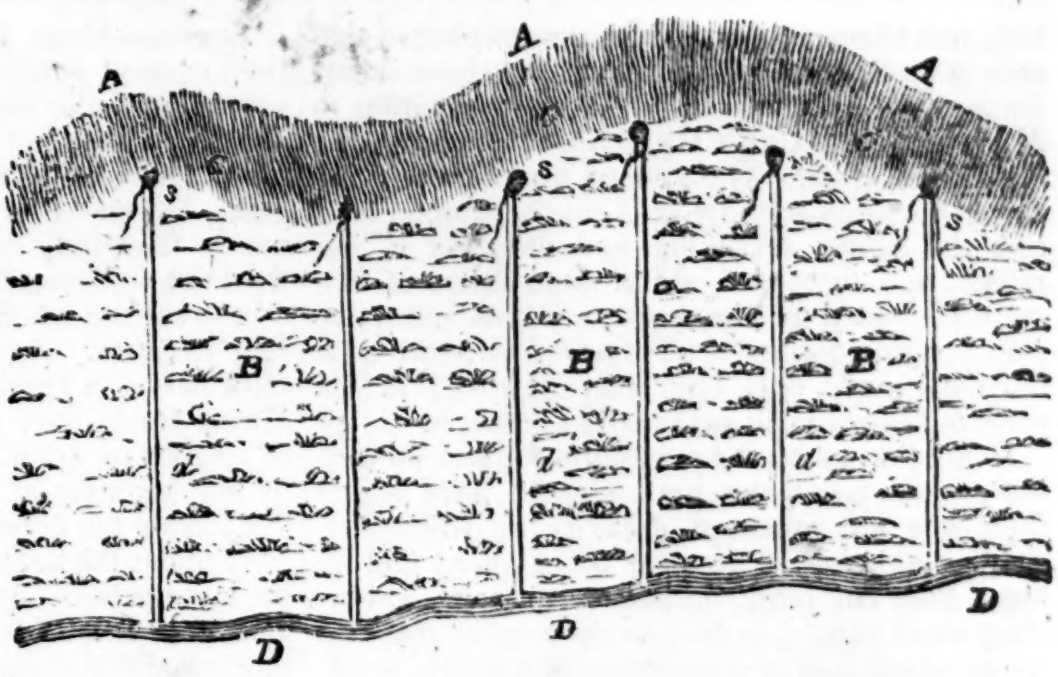
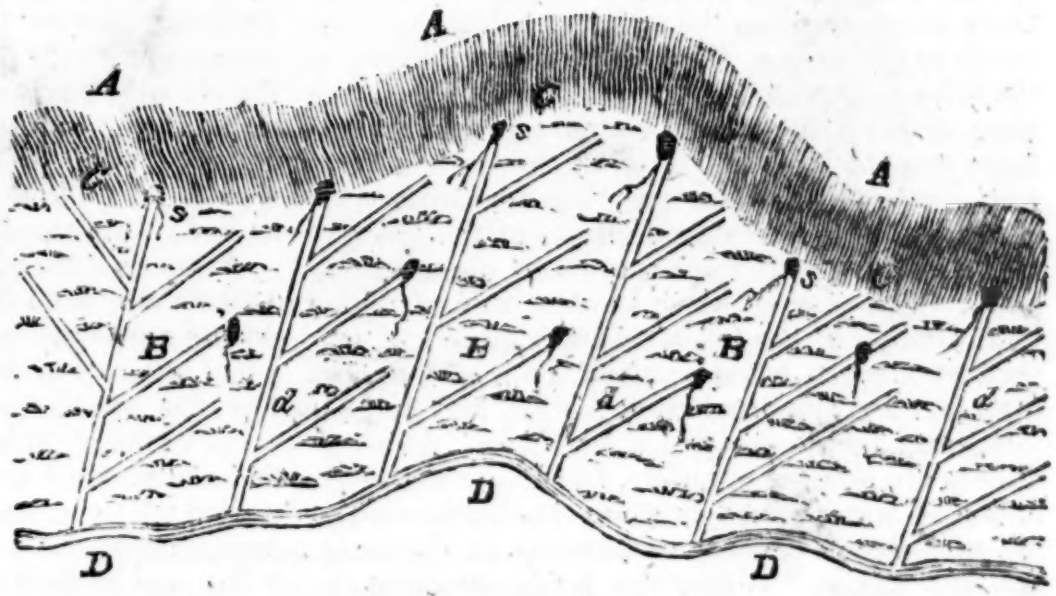


Fig. 2.

A A A High dry ground.
C C C Sloping ground.
s s s Line of upper springs.
B B B Boggy land with springs breaking out in various places and on different levels.
d d d Drains.
D D D Brook or ditch.



manner. Drains, in both these cases, are often left open for a length of time, to show their effect. This, in one sense, is a wise plan, for it often saves the labor of filling them, which would only increase a useless expense. One drain, properly conducted, has often effected a cure, where these numerous cuts have failed; and in many cases, where they are imperfectly executed, they only puzzle the person who is to lay out the work a second time, by the artificial appearance of springs, which their bursting out may exhibit. The principle on which their drainage is founded, with the practical directions applicable to it, will be fully explained in Part II. of this treatise.

SECTION V.

Of under and surface draining clays, loams, peaty and moorish soils, sand, and other porous soils, on a retentive bottom.

Clays.—In proceeding to the drainage of clay soils, it is first necessary to observe whether the field is perfectly flat, or whether it has a declivity, and in what direction; for by this it may be ascertained, whether the wetness proceeds from under, or from surface water, and consequently what kind of drains to apply. If the surface be flat and almost level, the wetness may proceed only from the stagnation of rain water; but if it has a descent, it is a sure indication that the wetness is produced by the overflowing, or soaking of water, from springs in the upper ground, or from subterraneous water in the field itself; for no water will lie on a surface that has a descent. The not attending to these circumstances is the reason why so many failures happen in the draining of clay soils, by a misapplication of the proper means. Fewer errors can be committed in the direction of surface drains, especially if they are open; for where there are hollows, and consequently stagnant water, it requires little nicety of judgment to discriminate what is the proper line in which to conduct them; but much labor and money is often expended in applying an improper remedy, by making deep covered drains, when small open cuts, or a few covered drains of no extra depth, might effectually succeed. When the wetness that injures clay soils proceeds from the water of a neighboring spring, it may be cut off by one drain of proper depth; but where there is a general oozing out of water from a porous subsoil, and where the field has little descent, several drains may be necessary *across* it, three or four feet deep, with two feet of stones at bottom. Where the wetness is occasioned by flatness of surface, and no regular descent for the water to pass from it, it is often kept dry by a proper form and direction of the ridges and furrows, with small cuts or water-furrows, in the hollows that cannot be levelled or filled up. In the carses* of Gowrie, Stirling, Fal-

* There is no term in England that corresponds exactly with "carse." It is used to designate an extensive stretch of flat or level land, on one or both sides of a large river where the tide flows, and which has, at one time, been covered with the salt water. Its soil consists chiefly of a strong clay loam, formed by alluvial deposite; and the substrata is always found mixed, more or less, with shells and other marine productions.

kirk, and Clackmannan, where the draining of clay soils is so well understood, much has been done; particularly on the valuable estates belonging to Mr. Paterson of Castle Huntly, Lord Dundas, and the Earl of Mar. The general drainage of these carses has been accomplished chiefly by open cuts, and the proper formation and direction of the ridges and furrows. As a description of the method adopted for draining one of these extensive clayey tracts, applies to all of a similar nature, the following mode, that has been practised in the carse of Gowrie, will sufficiently explain it.

In the first place, the proprietors, by mutual consent, marked out the most eligible lines where there was any apparent declivity, or where the water stagnated in greatest abundance; and in these lines cut large drains, called *pows*, resembling small canals, as deep as the level of the Tay would admit, and of a corresponding width, to receive the water from the adjacent fields, and convey it to the river. These *pows* are so sloped at the sides to prevent their falling in, that the plough goes within a little of the bottom of them. Such large receptacles being dug, ditches of a smaller size, surrounding and intersecting the farms, were drawn so as to serve for divisions of the different fields, and to empty their water into the adjoining *pows*. The size of these ditches was regulated by the extent of the fields, and the quantity of water they were to convey; their depth seldom less than four feet; their width at top six, and the bottom, from one, to one and a half feet. All these ditches are scoured annually, to prevent that stagnation of water to which so level a surface is liable, and give it as easy a discharge as the situation will admit. Where the fields adjoining the ditches, are of a uniform level surface, the common furrows between the ridges, if kept sufficiently clear, will serve to keep the ground dry; but as it seldom happens that any field is so free of inequalities, the last operation, after it is sown and harrowed, is to draw a deep furrow through every hollow of the field, in such a direction as to communicate with the other furrows that divide the ridges, and with the ditches at the extremities of the inclosure. When this track is once opened with the plough, it is widened, cleared out, and so shaped with the spade, that it may discharge the water freely. Where there are several inequalities in a field, it is necessary to have as many of these open cuts as will take the water out of the whole. They are called *gaas*, and to keep them clear, is a very essential part of every carse farmer's attention. Experience has also taught them the propriety of ploughing so, as to prevent any inequality in the fields, and to form the ridges so that the crown shall not be too much elevated and enriched, nor the sides next the furrows low and impoverished, but that every part may be rendered as equally dry and fertile as possible. Indeed, the change that has taken place in the beauty and fertility of the carses, by draining, squaring, and equalizing the fields, straighting the ridges, removing the *baulks*,* and other improvements, make them now appear equally rich and productive with any similar districts in the south of England.

Baulk. A narrow waste space betwixt each ridge, which certainly *baulked* the operation of cross-ploughing, &c., and so interrupted the improvement of the soil.

Loams.—From the excellence of the soil, and their general fertility, the drainage of loams deserves particular attention. The soil of *haughs* or *holms* (as they are called in Scotland) which lie along the sides of rivers and brooks, is, in most cases, composed of loam, or rich alluvial earth, and is frequently injured both by springs issuing from the adjoining banks, and from water lodging on the surface where the field is level, as is generally the case. As the subsoil of loams is for the most part of a porous nature, from which water is *drawn freely*, they may be considered the easiest of all soils to drain. The method is, to proceed by making a cut of proper depth (from four to six feet) along the upper side of the flat, and immediately under the bank or rising ground from whence the springs issue, giving it a fall and outlet to the nearest point of discharge. If the field is extensive, a parallel drain of similar dimensions *may* be necessary *across* the flat. In surface draining loams, fewer cuts are necessary than in clays, for the water is easily extracted from every part of the soil. In the surface drains, the stones require to be filled to a greater height than in those for springs; but the depth of the trenches require to be less; from three to four feet is sufficient.

Peaty and Moorish Soils.—These are more frequently wet from surface, than from spring water. As the upper soil is generally not more than from a foot to two feet deep, and under that a retentive clay, the whole body of this soil gets filled with water by heavy rains; and as it cannot subside, it remains soaking and chilling the upper earth till carried off by exhalation, or proper drains. These drains require to be many in number, if the ground is flat, and should always be cut at least a foot in the clay that is below the upper soil. There are many moors in Scotland of large extent, where this kind of soil forms the upper stratum, which, if drained, might be turned to good account, by being converted into arable land, or laid down in grass. The first thing to be done, in draining such ground, is to lay out proper open drains or ditches, in such a direction as to subdivide it into regular fields or inclosures, and to intercept the springs (where these may be,) or pass through such hollows as may retain the most stagnant water. Into these ditches, it will be easy to conduct any covered drains, or smaller open ones, as circumstances may point out. The ridges in land of this description should be very narrow, but not much raised in the crowns, otherwise the accumulation of soil there will impoverish the furrows, make the middle of the ridge soft and poachy, and, when in pasture, the furrows full of rushes. These are the soils, when drained, where paring and burning is an essential aid to their improvement. More will be found concerning them, in the Appendix.

Sand, and other porous soils on a retentive bottom.—It is evident, from the nature of these soils, that surface draining applies to them more properly than deep cutting; for, as the water is all lodged in the upper stratum, there is no necessity for going any deeper than a few inches into the clay that supports it. Where a spring or springs do arise in such, they spread their influence to a considerable extent, and therefore by cutting them off completely, one or few drains may have a wonderful effect. The whole upper soil being porous, the water of the springs either rising along

the upper side of the field, or bursting from under the clay in any part of it, will flow through the loose soil in every direction, and will keep it in a constant state of wetness. Cutting off these springs, therefore, in the first instance, may effect the cure, and is always on that account to be first attended to. But the wetness in these soils, proceeds more from the absorption of rain water, than from that of springs; and therefore surface draining applies to them with more propriety. As the water, after it has saturated these soils, will readily flow to any drain that may be made in them, a cut in the middle, if the field is flat, will answer the purpose; or, if it has a descent to one side, a drain at the lower end may draw off the injurious water. This drain may, without inconvenience, be left open; but as the looseness of the soil is apt to crumble down and fill it, it will require to be frequently looked at, and cleared out when necessary. The interior drains that may be wanted, should all be covered in the usual manner; and as they are liable to choke in a sandy soil, their outlets will require to be frequently examined.

SECTION. VI.

On the draining of mixed soils, or those composed of alternate beds of clay and sand, &c.

Besides the soils that have been mentioned, there are others of an intermixed variety, and where the changes of clay and sand, or of those strata that are porous, and those that are not so, take place within the limits of the same field. Draining, in these cases, is attended with more difficulty and expense, than where the surface and internal strata are more regularly disposed. In these kinds of soil, where every reservoir of water is unconnected with another, (being separated by intervening beds of clay,) the partial collections of water they contain are so augmented in time of rains, that being full to the level of the surrounding clay, the water so overflows, as to render it wet, sour, and unproductive. As these sand beds have no communication with one another, it requires as many drains as they are in number, to extract the water from each of them. From the nearest and lowest part of the field to be drained, a trench is cut, up to the highest and most distant sand bank, in such direction as to hit on some of the intermediate sand beds, which saves making a side-cut that might otherwise be necessary. But, where this would give many awkward windings to the main drain, and would consequently lengthen it, and where crossing the beds of sand, that are higher than the surface of the surrounding clay, would considerably increase the depth, and, if rock, or running sand, would add to the difficulty and expense of working it; in such cases, drains in form of the letter Y must branch off to these beds, to draw out the water they contain, and convey it to the leading one, as represented in plate No. II. Although the sand beds throw out

Draining of mixed soils.

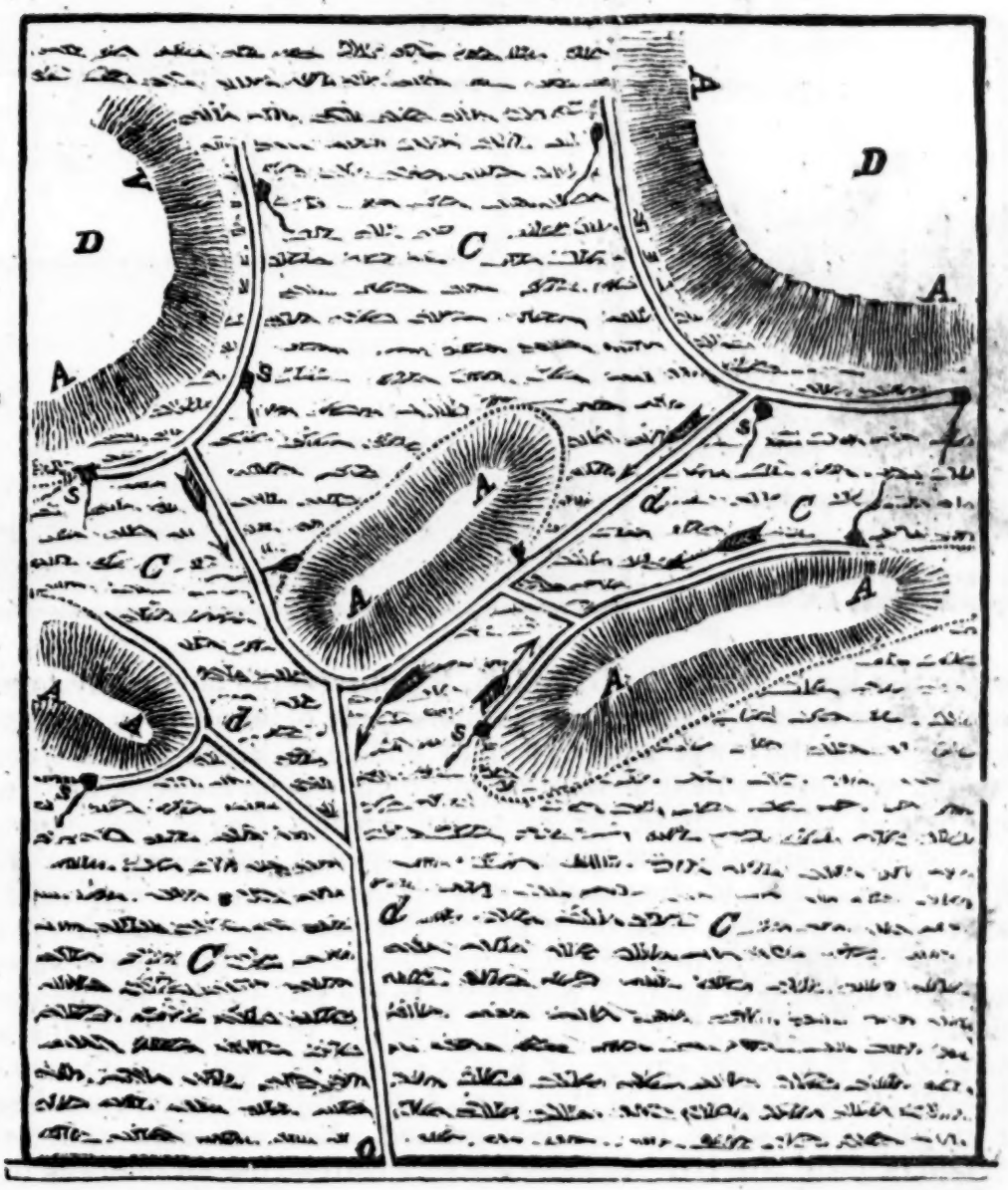


PLATE II.

D D Dry ground.
A A, A A, A A, A A, A A, Porous rock or sand.
s s s s Various springs.
C C C C C Clay soil, wet and rushy.
d d d Leading drain and branches.
o Outlet into brook or ditch.

the water on all sides, so as to wet the clay that surrounds them, a drain on one side will take the water from the whole, if that, where it is cut, be the lowest. But, it must be observed, that unless the drain is so cut, it cannot have that effect, while the water on the oposite side of the bank can find an outlet lower than the drain. It is of consequence, therefore, to consider this by previous ex-

amination of the ground; and by applying the spirit-level, where it is not apparent to the eye, the lowest and proper side for the drain, is thus readily found. If the water issuing from the sand-banks, has been observed to flow in dry seasons, at one side, and not at the others, it is a proof of that being the lowest, and consequently the proper line for the drain. By cutting it in this direction, the water will be prevented from afterwards rising to the height of the upper outlets, even in the wettest seasons. In many cases, in ground of this description, the whole water that causes the wetness may proceed from the upper springs passing *over* the upper soil, and *through* the different sand-beds, being prevented from descending lower than the retaining bed of clay. In this case, the drainage of the whole field, may be accomplished with less difficulty and expense, than in the former; as the upper drain from A to B, in plate No. III. will intercept and carry off the principal springs, and

Drainimg of mixed soils.

PLATE III.

Fig. 1. *Horizontal Plan.*

A B Deep covered drain to cut off the principal springs.
G G G Dry ground.
o o o Springs.
H H H The dividing line between wet and dry ground.
K K Sand bed.
I I I I Dry Surface.
L L L L Wet swampy land.
M Outlet of drain.
N N Ditch.
C C, D D, E E, F F, Branch drains emptying into the main drain D M.

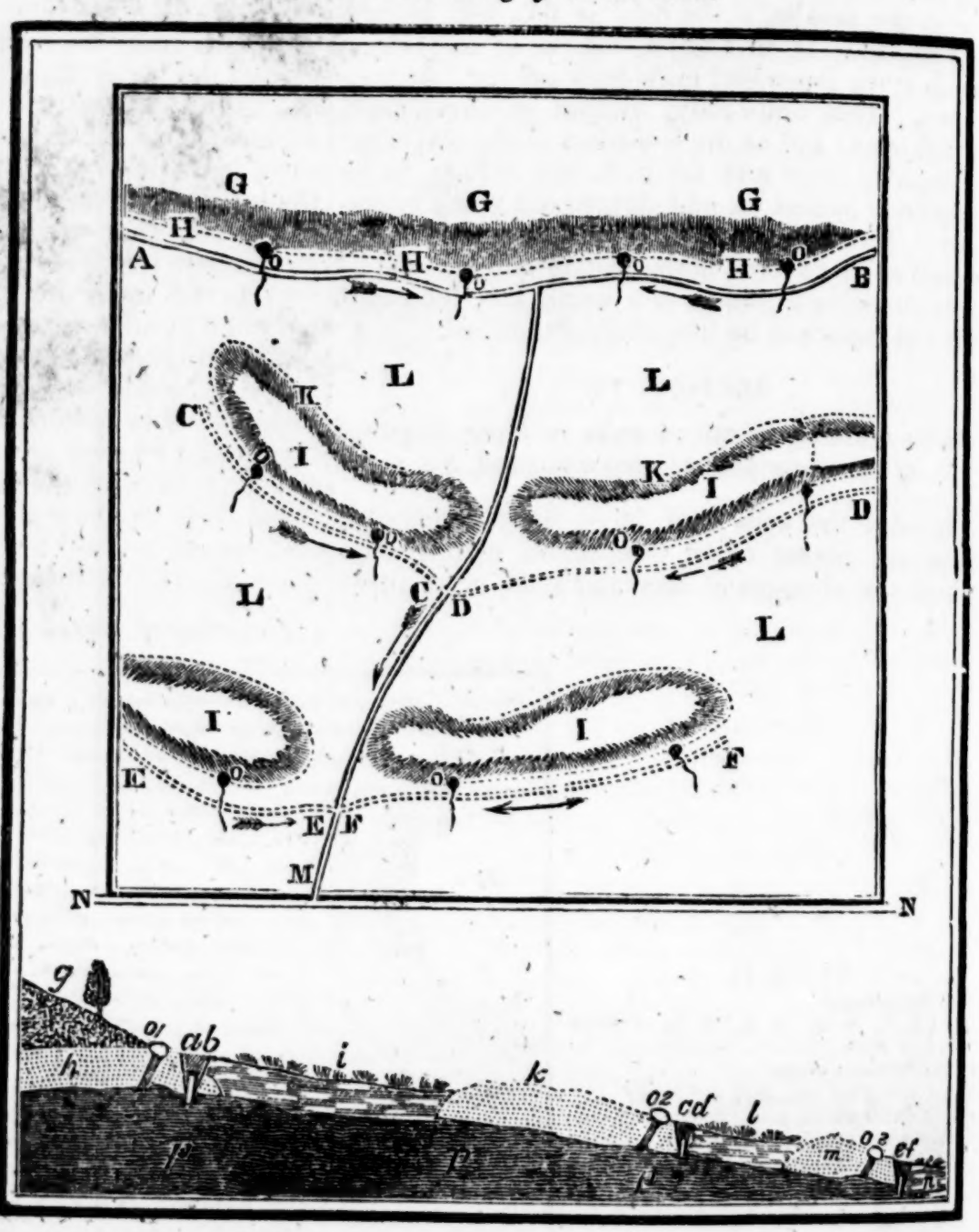


Fig. 2. *Section.*

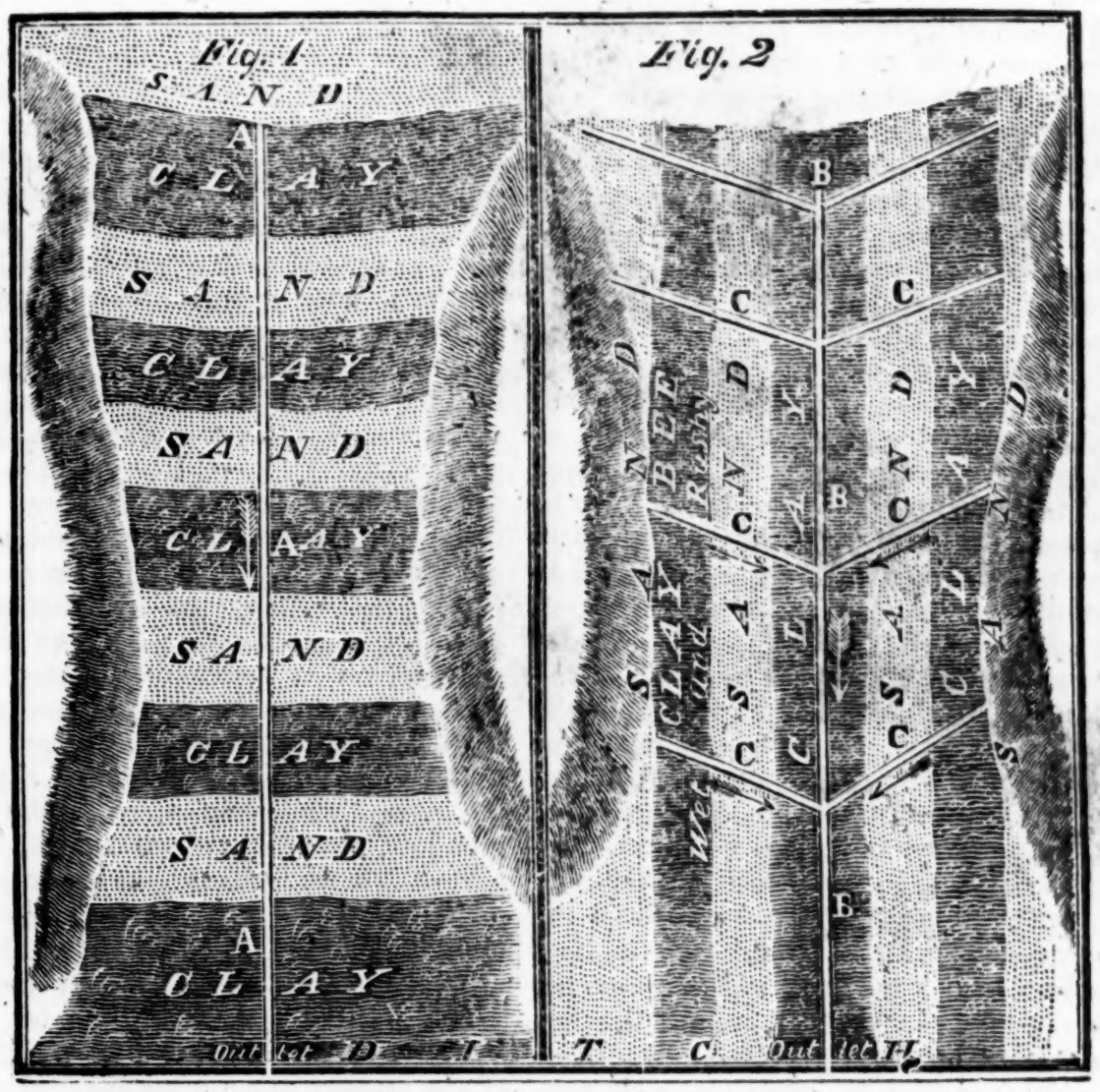
a b Drain (A B in Fig. 1)
c d Drain (C D in Fig. 1.)
e f Drain (E F in Fig. 1.)
g Dry ground.
h Porous strata.
i Upper soil, partly porous—wet and rushy.
k Sand bed through which the water of the principal spring passes.
l Wet and rushy ground.
m Sand bank.
n Wet and rushy.
o1 o2 o3 Springs.
p p p Retaining bed of clay.

render the lower drains C, D, and E, F unnecessary, unless merely to extract the partial supply of water, which the lower sand-beds may imbibe in time of rain, and which, if they be of small extent, can do little injury to the adjoining surface.

From this it appears, that the line of *one spring*, in the highest tract of the ground, may be the *sole cause* of injuring a considerable part below, from its water overflowing the surface at one place, and subsiding under it at another, according to the tenacity or openness of the soil; and therefore, in such cases, the upper spring or feeder should be first cut off, and the effect of that seen, before any more drains are made in the low ground. See section of plate No. III. Besides the soils corresponding to this description, there are others of nearly a similar nature, but each bed being of less extent, and lying more regularly together, they may be drained with less cutting and expense. Under the beds of sand and clay that thus lie alternately together, and almost parallel to one another, is a general body of impervious clay, that keeps up the water in the sand always so full, as to moisten, and in wet seasons overflow, the surface of the adjoining clay. This general substratum being seldom more than four or five feet below the surface, a drain cut to that depth through the middle of the field, (if it has a descent towards it from both sides,) will lay it dry; but if the ground declines to one side, the drain must be cut there, where the water will more easily discharge itself into it; and unless the field is of considerable extent, and has several hollows in it, one drain will answer the purpose effectually; for, by crossing all the beds that hold the water, it will draw it from each. See plate No. IV. Fig. 1. The difficulty, however, of draining land of this description, is, when the alternate beds of clay and sand lie in a direction across the declivity of the field: one drain, in this case can have no other effect

Draining of mixed soils.

PLATE IV.



A A A Drain cut in the hollow part of the field.
B B B Ditto.
C C C C &c. Branch drains.

than carrying off the water, after it has passed over the different strata, and would lodge in the hollow, if there was no outlet given to it. When the ground lies in this manner, therefore, besides the drain in the hollow, others must be cut from it in an oblique direction *across* the declivity, which, crossing all the different veins of sand, will extract the water from each. See Fig. 2 of plate No. IV. The first thing to be considered, in draining these mixed soils, is to examine minutely the inclination of the alternate strata, and how they lie with regard to the slope or situation of the field to be drained, for on this the proper direction of the drains depend. The external signs that distinguish the different beds, are easily perceptible from the appearance of the surface, and nature of the herbage that each produces; and this object is attained with least difficulty, when the ground is in pasture. When in tillage, however, it can also be ascertained, by observing the darker and wetter appearance which the soil, affected by the water, exhibits. One thing more requires attention in completing the drainage of these soils. If the field lies very much on a descent, care must be taken to lay out the side drains in a direction sufficiently horizontal, so as not to make the fall too precipitant, by which the bottoms of them would be worn uneven, and the passage of the water obstructed; but, to give them just fall enough to make the water clear its course. Where alternate strata are of greater extent, and where the wetness produced by stronger springs forms swamps at different levels, on the sides of hills and sloping grounds, and where deeper cutting, and the use of the auger is necessarry, the modes of draining will be explained in Part II.

SECTION VII.

On the draining of grass-lands not intended for tillage, as depastured with cattle or sheep.

This branch of the subject forms an important part of the system of draining.

In high countries, where black cattle and sheep are reared and fed, less attention is paid to the drainage of the pastures, that are wet and unproductive, than to that of the arable ground, although the effects in the one case be equally beneficial with those in the other. This neglect is often attended with serious loss. From the nature and unwholesome quality of the grass, which a superabundance of moisture produces, whether stagnant on the surface or confined under it, proceeds that incurable malady, the *rot*, and other diseases, to which many thousands of valuable animals fall a sacrifice every year. For this, draining is the most infallible preventive, and in such situations is attended with little expense, as the drains do not require to be of that depth which is necessary for tillage land, and may in all cases be left open, except in such places where the depth requires covered passages, to enable the sheep to cross over them in safety. In the southern districts of Scotland, particularly in the counties of Berwick, Rox-

burgh, Selkirk, and Peebles, most of the principal sheep-farms have been very much drained, and the consequence is, that the size, quality, and healthiness of the stock in these districts, have been thereby so much improved, as appears almost incredible to those who were acquainted with the former state of sheep-farming in those parts.* In many of these farms, the rent has increased *fourfold*, and the rot is now hardly known. The mode of draining adopted in these pastures is simple, yet effective. The wetness arises chiefly from the springs that issue from the sides of the hills, and, spreading over the surface of the descent, form such an accumulation of water in the hollows, or flats at the bottom, as to render them often so boggy, and productive of noxious grass, that the sheep are in danger of being drowned, and are always subjected to disease. The first thing, therefore, is to cut off the source of the springs by a drain carried along the upper side of the declivity, and to have as many others in a parallel direction, as the extent of the wetness requires, with such conductors in the hollows, as serve to lead the water to the burns at the bottom.

These drains seldom exceed two feet in depth, and therefore require to be the more numerous; and the stuff is always thrown to the lower side, to give access to the water that may come into them from the upper. The want of depth, however, renders them less effectual in most cases, particularly where the upper soil is soft and boggy; but if the depth was greater, (which it might be without risk,) the effect would be more certain, and the expense less, as fewer cuts would answer the purpose. The water collected by these drains is often turned to useful purposes, by irrigation. By conducting the upper drains, so as to lead it on a level as far as the nature of ground will admit, it is turned out, so as to run over such parts of the surface below, as are dry and covered with heath, where it has the effect of extirpating that plant, and encouraging luxuriant grass. This is so great an improvement, in addition to the draining, that the annexed plate, No. V. is given, to represent it more clearly.†

Besides the draining of sheep pastures in hilly districts, as has been thus explained, there are many extensive plains overrun with water, and covered with noxious grass, which, if subdivided, and drained by open cuts, would soon naturally produce better herbage, and maintain more and better stock. The small rivulets that run through them, are often so crooked, and incapable of containing the water, that these alone being straighted and deepened, would add greatly to their improvement. This indeed is the first thing to be done towards their drainage, after which, conducting the water by smaller courses into these, becomes a simple and easy process. They may be situated in such parts of the country unfavorable to their cultivation otherwise; but surely their drainage would be attended with advantage, by meliorating the climate, improving the pasture, and maintaining a greater and better breed of cattle; or, as meadows for producing hay for winter provender, they would pay amply for their improvement, where that commodity is so useful for rearing stock. In their natural state, they are often reserved for that purpose; but then the produce is so coarse and so scanty, that it ill repays the labor of cutting and preserving it. If drained, and afterwards limed on the surface, their produce would be greater, better in quality, and liable to less risk; for in floods, when the streams that pass through them overflow, the hay, such as it is, is often swept away or greatly injured. In many situations, such ground might advantageously be converted into water-meadow, by which, a still greater supply of grass and hay might be obtained; but this is a species of improvement, not much attended to yet in Scotland, except, on some parts of the Duke of Buccleuch's estate, and on that of Pitfour in Aberdeenshire, where, indeed, it has been successfully practised, and is now generally understood. The influence of such examples, bids fair to extend its practice, in situations where it is practicable; for, like many other improvements in agriculture, there is a prejudice against it, arising from the want of knowing, or an opportunity of seeing, its effect.

In the immediate vicinity of Edinburgh, there are several hundred acres of the *richest* water meadow, producing about £40 an acre annually; part of which, in its original state, was not worth a shilling per acre. The discharge from the common *sewers* that drain the city, affords a *full* supply for this *foul* irrigation; but there is a maxim in husbandry, "Let nothing be lost!" But, though this species of irrigation adds to the *rental* of the owners, it contributes nothing to the *health* of those who live near it. In the summer months, the *malaria* is almost insufferable. Part of these meadows lie within a few hundred yards of the *royal palace* and the horse barracks!!!*

The cholera of 1832 was more prevalent in the districts adjoining these *mires*, than in other localities. Milk-cows are chiefly fed with the product of these fields, which must affect the *flavor* of that most useful *fluid*, as much as it does the *salubrity* of the *air!*

A "Board of Health" would certainly recommend their drainage, and the ground being converted to other useful purposes, like that in the site of the North Loch.

SECTION VIII.

On the draining of corn-land, pastures, and plantations, with open cuts and subdivision fences; and of the form and construction of open drains in general.

It often happens, that corn-lands and rich cultivated pastures, although inclosed and divided into regular fields, are imperfectly drained, by not, at first, attending to the proper direction of laying out the ditches, so as to serve the double purpose of drains as well as fences. A frequent error also occurs, in not making the ditches of a proper depth, especially if the ground is flat; and consequently any interior drains that lead into them, must be subject to the same fault. Where the ditches have been cast in a good direction, the simple remedy is to deepen them where there is level to do so; and if the direction is improper, it

* The writer of this Treatise drew up, (along with his father,) the 'Agricultural Reports' of Peebles and Selkirkshires for the Board of Agriculture, in 1794. He is therefore enabled to state the above fact from personal observation.

† See plate No. V. on page 529.

* A *hint* to Government.

may be preferable to make them anew; but if hedges or fences are already planted along their line, they may not be so easily altered. In that case, auxiliary cuts may be necessary, and if the inclosures are large, these cuts may remain open, as lesser subdivisions of the field. Where it may be necessary to deepen the old, and open these new cuts that are not to be fences, the earth thrown out should be all removed, and spread in the lowest part of the field; for if left on the sides, it occupies ground unnecessarily, prevents the free admission of surface water, and presses down the sides of the ditch or drain. If the water, which it is the intention of these drains to carry off, should proceed from springs, and their depth on that account requires to be the greater, there may be some risk of their falling in; but to lessen the depth, pits may be sunk, or the auger may be applied, successfully. There is no danger of the holes filling up in these open drains, provided no great quantity of flood, or of surface water, is admitted into them; for such is often the force of the spring, that it will throw up any sand or sludge, that may get into them; but the better to secure them against any obstruction that might ensue, small openings may be made along the upper side of the drain, at the height of six inches above its bottom, and in these the perforations may be made, and covered over with a flat stone at top. This will effectually guard them against any injury that might arise from the influx of surface water, or from the falling down of any substance from above. Passages, by means of small bridges of wood or stone, should be made at convenient places where cattle may pass, as nothing is so detrimental to open drains, as cattle passing over and breaking down the sides; and where very deep, it may be dangerous to the cattle themselves. This precaution, therefore, cannot be too much attended to, in all pastures that are intersected by these drains.

The proper management of woods and plantations, is a matter of general importance. Draining is an improvement of essential consequence to them, as well as to land in cultivation or in grass. It is often, however, so little attended to, that ground considered so wet as not to pay for the expense of draining, is covered with trees to prevent its being a disagreeable object in its particular situation. The result of this is what might be expected; the trees never come to perfection, and, in fact, give a more steril and unpleasant aspect to the surrrounding grounds, than the surface of that part of it did, before being planted. In short, wet ground that is intended for planting, requires as much to be drained, or even more so, than that either for corn or grass; for the roots or trees penetrating deeper than those of any other plant, the necessity of removing the *under*, as well as the surface water, is evident. On the estates of Cariston in Forfarshire, and of Skene in Aberdeenshire, many extensive and thriving plantations of the various kinds of trees have been made; and in every situation, where the ground was in need of it, drains were first cut, and are frequently renewed or repaired, as circumstances require. The consequence is, that these woods, are not only in the most forward and thriving state, but of a growth and size remarkable for their age. The late proprietor, who was a great advocate for planting, as well as an active promoter of every rural improvement, did, by his own example and spirited exertions, introduce the practice of draining, *in all its branches*, into that country, on a very extended and liberal scale.*

At Glammis in Angus, and at Blair-Adam, in the county of Kinross, where the plantations are on a very extensive scale, draining has been particularly attended to, which marks the progress of the late planted wood, in a very remarkable degree. In young plantations, open drains are the only kind applicable; as the roots of the trees getting among the stones, and leaves choking their outlet, would soon render covered drains of very little use. In *lawns*, and among *thin grown-up* wood, covered drains may be more proper for cutting and carrying off springs, where they are not so liable to any defect, from the interruption of roots and leaves, and as they do not present so disagreeable an object to the eye, as open drains.

It is unnecessary to give minute directions for the depth and width of open drains, as these must depend on the nature of the soil, and situation where the drains are to be made; but one general rule ought always to be attended to, that the width at top should be *three* times as much as that which is necessary at the bottom; for the width at bottom is always according to the quantity of water the drain has to convey. This width at top is requisite, to give a sufficient slope and stability to the sides, to prevent their falling in; and the fall or declivity should always be such, as to allow the water to run off without stagnation, but not with so rapid a motion as to injure the bottom. The first is necessary to carry off any sludge, grass, or other obstruction which the water may meet with; but, if the descent is too great, the water will form inequalities in the bottom, and also endanger the sides. In moss, and in very soft soils, even a greater degree of slope may be necessary than what is above mentioned; and in all cases, where it is meant for a drain only, (*i. e.* to receive and carry off water without any regard to its being a fence), none of the earth thrown out should remain upon the sides, for the reasons already stated. In soft marshy ground, where it may be proper to make the line of drain a fence, the bank of earth thrown out, (which should always be on the lower side), may remain, and a small parallel cut be made at the back of it, to receive the surface water from that side, and to convey it to a proper place, where it may be admitted into a larger drain. In all cases where the admission of surface water, or what may be much increased in the time of rain, is unavoidable, the drain must be open, to prevent the risk of choking or filling up, which would always happen if it were covered. This, however, in the middle or hollow of an improved field, would be hurtful to the eye, and obstruct the act of ploughing, if formed in the ordinary shape; but may be remedied by giving the drain such an additional slope, that grass may grow on the sides, and the plough pass over it with little obstruction; and if the direction of the ridges is laid in a line parallel to it, there will be less interrup-

* The author having enjoyed the patronage and friendship of the late *Skene* for upwards of twenty-five years, he cannot resist the desire of recording here, his unfeigned regret for the loss of such an inestimable friend. The counties of Aberdeen and Forfar, in which his estates lay, have also lost one of their most zealous and active improvers.

tion to the cultivation of the field. When the field is in pasture, this drain can have no bad effect whatever, as the cattle pass over it with ease; and being covered with grass to the bottom, nothing is lost. If there be a constant run of water in it, that may be confined to a narrow channel, cut a little deeper in the middle; but however great the slope, the sides should never be ploughed with the rest of the field, but should remain always in grass; as a sudden or great run of water, after heavy rains, passing through it when loosened by ploughing, would wash down the sides, and destroy its shape.

Very small and narrow cuts, commonly called *grips*, are very useful in the wet hollows of smooth pastures, to receive, and carry off from the surface, the rain water as it falls. They are commonly one foot deep, eight or ten inches wide at top, and the sides so contracted as to meet in a point at the bottom. They are easily stopt by the feet of cattle, but are very soon cleared out.

Sunk fences, (commonly called *ha, ha's*), which are used in parks, for the division of lawns and pleasure-grounds, come under the denomination of open drains, being always useful in that respect; but as their form and manner of construction are so generally known, and vary according to situation and other circumstances, it is unnecessary to give any further description of them here.* It may be added, however, that when required for a drain in such situations, they should be deeper than in ordinary cases, and that the earth thrown out, in place of being heaped upon the side, and raised above the level of the surface, should be removed, or so spread, as not to appear so bulky as it is sometimes allowed to do. All open drains require to be scoured out, and cleared, at least once a-year; for when this is neglected, they lose their effect, and the operation afterwards becomes more difficult and expensive.

Large open drains for the purpose of straighting, deepening, and confining the water of rivers and streams that are apt to overflow, being connected with embankments, will be described in the part allotted to that subject.

SECTION IX.

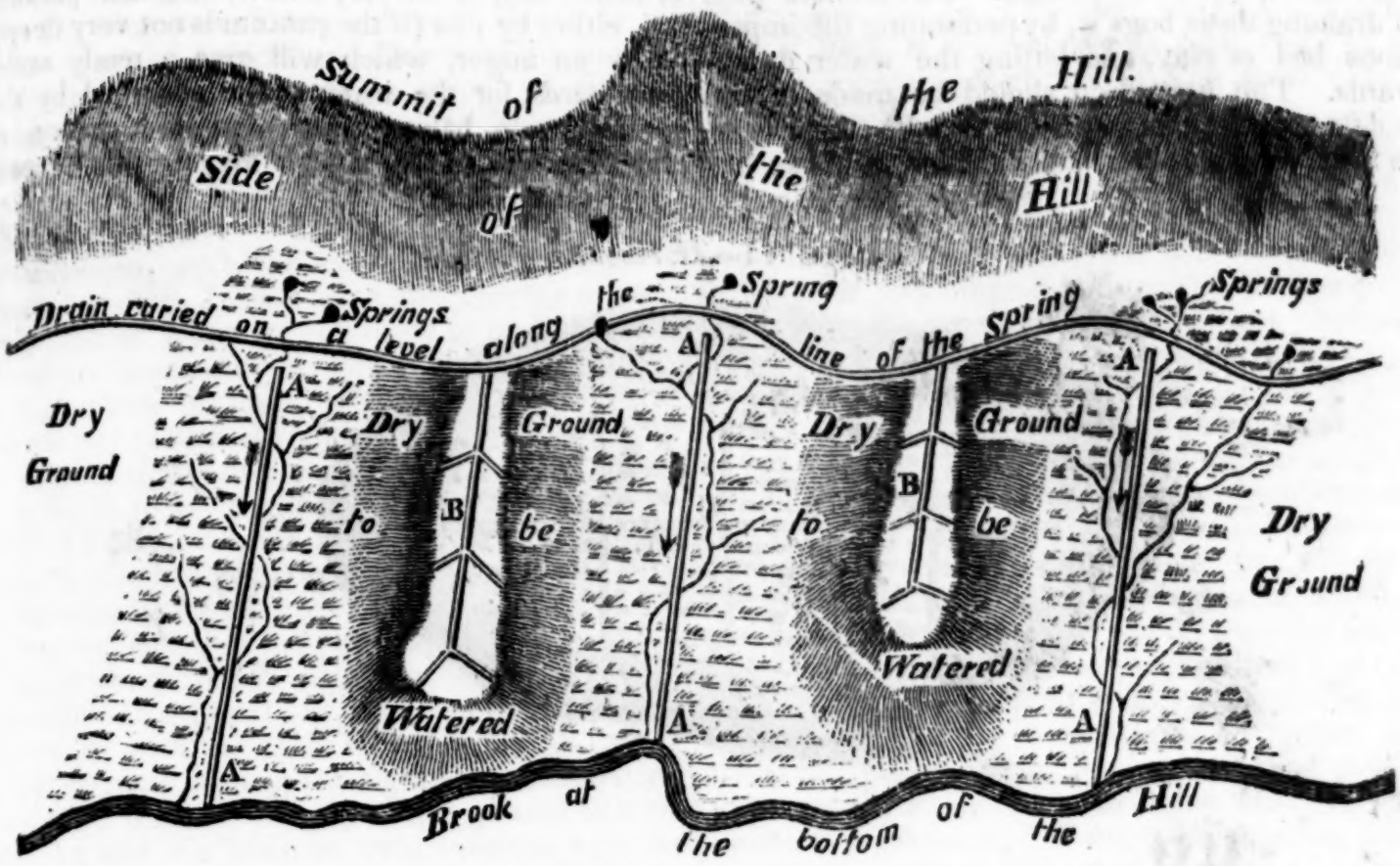
On the Draining of Lakes, Land-locked Morasses, &c.

The objects in the draining of Lakes (or *Lochs*, as they are called in Scotland), are threefold: First, for the sake of the land that may be gained when the water is removed; second, for the marl and rich earth that may be got in the bottom; and, thirdly, for the purpose of obtaining level, to drain extensive tracts of meadow and marshy ground adjoining, which cannot otherwise be accomplished. Add to these, the beneficial effects of also improving the climate in their neighborhood. In many cases, all these objects are acquired at the same time, which renders such drainage of the greater importance. In Scotland, many lakes of considerable extent have been drained, and all these objects fully attained; and there are others equally practicable, several of which it is now in the contemplation of the proprietors to drain. One drawback that frequently happens to the draining of lochs is, several owners, having an interest in different mills, that are supplied with water from that source; and where that is the case, they may remain long in their present state. In many parts of this country, small lochs and dams are kept up for the sake of mills under old tenures; which, if drained, the land gained by that operation would, in many instances, be worth *ten* times the rent of such mills. The most considerable drainages of lakes that have taken place in Scotland, are the following: the lochs of Spynie, Leuchars, and Coats, in Morayshire, where above one thousand acres of valuable land have been gained, and level afforded to drain the adjacent grounds, formerly impracticable. The drains from these lochs have very little fall, being near to, and having a direct communication with the sea. From the nature of the loose and blowing sand through which they are cut, they have likewise been an expensive and difficult operation. The lochs of Kinnordy, Restennet, Rescobie, Lundie, and others in the county of Forfar, have been drained for the sake of the vast quantities of shell-marl which they contain, and which has been the means of accelerating, in no small degree, the agricultural improvement of that country. The great loch of Forfar has also been partially drained, or lowered, on that account. The meadows of Logie, and of Belmont, in the same county, formerly lakes, have lately been completely drained; have produced an immense store of marl, and are now converting into arable land, the most fertile and productive in that part of the country. Lochore, in the county of Fife, has been completely drained, and is now turned into arable land; and Loch Leven, in Kinrossshire, has been lowered as many feet as will relieve from wetness, and give fall to drain many hundred acres of useful land adjoining. The Loch of Strathberg, in Aberdeenshire, was some years ago attempted to be drained, by an enterprising individual of that county; but after an outlay of many thousand pounds, the obstacles to its completion were found so great, that the further prosecution of it was abandoned. It is close to the sea; but the tract through which the drain had to pass, being a loose and blowing sand, filed up soon after being excavated. Wind-mill pumps were next tried, which threw up the water of the loch over the bank, at its lower extremity; but the nature of the sand being such, the water was absorbed by it, and returned again to the loch. In Roxburgh and Selkirkshires, and in the counties of Dumfries and Galloway, several small lochs have been drained for marl; and in these counties, many others are capable of being drained, where marl is also to be found. In the northern counties, there are many lochs, where, although no marl has yet been discovered, draining, or at least lowering their water, would be attended with beneficial consequences to the adjacent fields and meadows. In the county of Aberdeen, there are several, where it would be particularly so, on account of the valuable land that would be gained. In the instances above mentioned, many thousand acres have been added to the productive soil of the country, besides the immense store of marl that has been obtained; and although this was attended with considerable outlay at first, the result has been very profitable to those concerned.

* The name *Ha, Ha*, must have originated thus—In passing (for the first time) from one part of a lawn to another, and finding an unexpected and *unforeseen* interruption, the person would naturally express his surprise by ejaculating *ha, hah!*

Draining Sheep Pastures, &c.

PLATE V.



A A A A Open drain in the wet hollow.
B B Flooding trenches for irrigating the dry ground.

The difficulty and expense of draining lakes must depend on their depth, the nature of the ground through which the drain has to be cut, and the distance to which it must be carried, to obtain the requisite fall and outlet. These circumstances are easily ascertained, by exploring the depth of the water, and the materials to be cut through, and by taking levels accordingly. When this is done, an accurate estimate of the expense can be formed; and when that is compared with the probable result, the utility or impropriety of the undertaking can then be determined. It may often occur, that it is preferable to make the cut for draining a loch in a new and different direction from that in which the water has its natural outlet, and this can be readily ascertained by the means that have been stated. Lakes have also been drained by opening a mine or subterraneous tunnel from the nearest outlet to the level of the lowest part of their bottom, and this may in some cases be done at the least expense; but in others, it may be a hazardous, and sometimes a dangerous undertaking. In these cases, *shafts* or pits should be sunk from the surface down to the mine, at certain distances, which would give light, air, and less risk during the operation. It may sometimes be advisable to arch the drain, and cover it in when very deep, which adds to its security, in situations where the ground is soft, and liable to fall in, and when it also lessens the labor of raising the stuff from the bottom, which must otherwise be carried to a distance from the sides. By this means, the width of the cut may be less; and as a few yards are arched, the stuff of the next few yards is thrown above that part of the arch last made; and so on, in this manner, through the whole length of the line.

That lakes may be drained by boring, or sinking pits to some absorbent strata below, is impracticable, on account of the great body of water, which no pit, nor any number of auger holes, could receive. This, however, has been imagined by some, and has been described in a treatise by the late Dr. Anderson, but has never in any case been put in practice.

Besides lakes containing a great body of water, to which the foregoing observations particularly apply, there are, in many parts of the country, bogs and watery morasses, surrounded by fertile grounds, which it would be an object of no less importance to drain. These are neither produced by water rising in themselves, nor by that of springs in the adjoining banks; but become wet, by an accumulation of rain water stagnating on an impervious subsoil, through which it can have no descent, and being surrounded by higher ground, through which there is no vent nor natural discharge for the water.

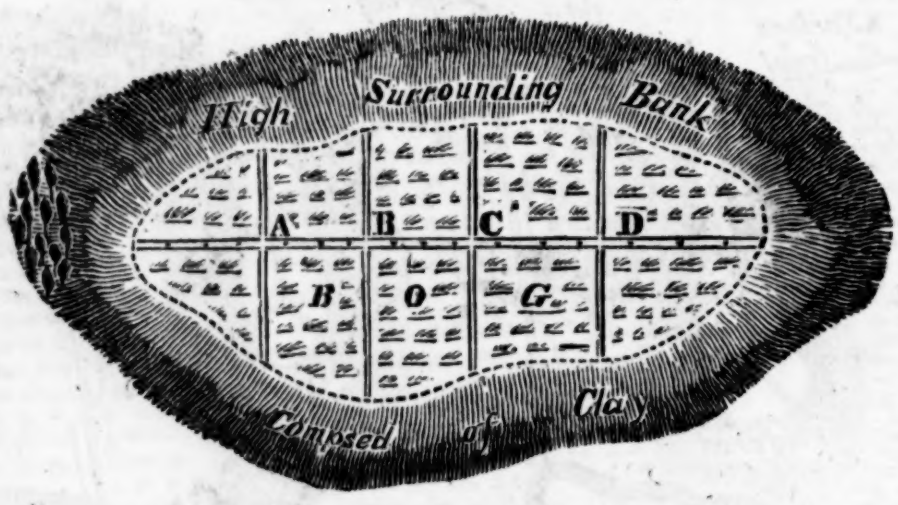
Such are commonly called *land-locked bogs*, or morasses. In the eastern part of the county of Peebles, there are many bogs of this description, and some of them have been drained in the manner to be described; and on the estate of Mount-Annan, in Dumfries-shire, General Dirom successfully drained one of considerable extent, in a similar manner.

The situation of these bogs being often much lower than the ground that surrounds and confines them, the cutting a drain or conductor through the bank, for conveying the water collected within, would be attended with an expense greater than the value of the land when gained. The thickness and closeness of the retaining stratum of clay is often such, that although the strata under it be of a porous and absorbent nature, as rock, sand, or gravel, the water can find no passage by which to descend; and therefore, by its long stagnation causing the decay of the coarse vegetation that is produced, it forms a morass, equally soft, and less productive than any spring bog, is seldom pastura-

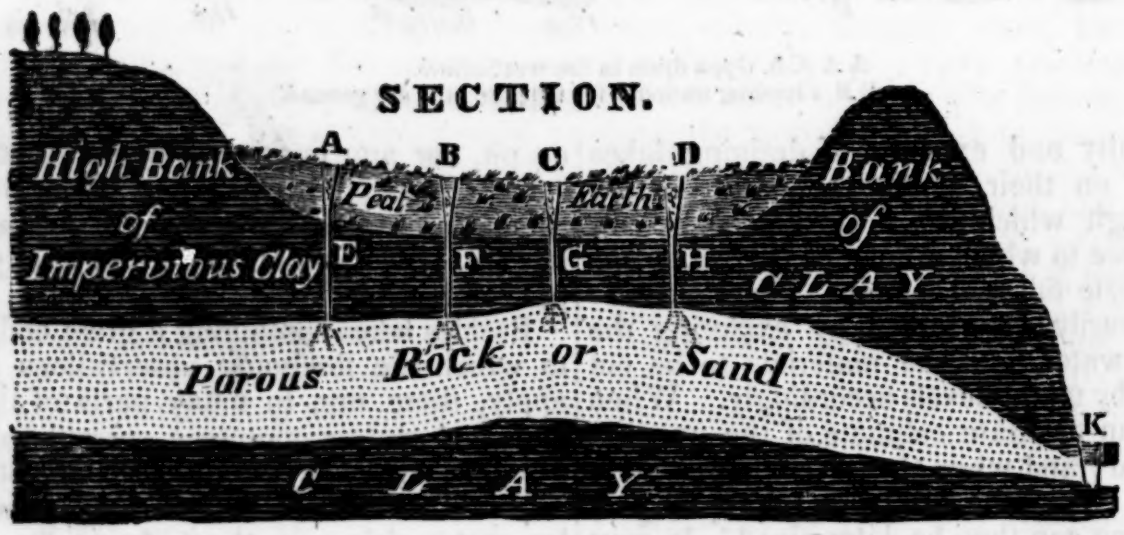
ble by cattle, unless in very dry seasons, when its moisture is partly exhaled, and is never at any time accessible to the plough. The method then of draining these bogs is, by perforating the impervious bed of clay, and letting the water downwards. The first drain should be made in the middle or lowest part, and into this the others must be led. The number and direction of these depend on the extent and form of the bog to be drained. They must be all cut, through the peat or mossy soil, to the clay below, and this, perforated, either by pits (if the stratum is not very deep), or by an auger, which will give a ready outlet *downwards*, for the water to be absorbed by the porous strata below. See plan and section of plate No. VI. The drains may be cast as nar-

Draining of Land-Locked Morasses.

PLATE VI—*Horizontal Plan.*



SECTION.



The letters A B C D, in the Section, correspond to those in the plan above, and represent the drains cut through the peat earth, and filled up with loose stones to within a foot and a half of the top. E F G H represent the perforation of the clay by the auger holes, and the descent of the water into the rock below.

row as possible, and should all be covered; for if open, the rain-water might carry in sand or mud, and choke the auger holes or pits that are made. They should be filled, to within a foot and a half of the top, with small loose stones or coarse gravel, that the water in the peaty soil may find its way readily into them, and subside downwards to the holes or pits that are to convey it to the porous strata below.

Before proceeding to drain this land in the manner above described, it is proper to consider, whether the porous strata under the clay may not already contain water, and, in place of receiving that from above, may throw up a greater quantity from below, and thus, instead of curing the evil, render it worse. This may sometimes be the case, and the sabstrata may contain water that makes no appearance at the surface in this place; but being connected with, and supplied by some higher springs, may flow up, when a vent is thus given to it. If the surrounding ground declines lower than the bog, though at a distance, by means of a spirit-level, and the appearance of the surface, the nature of the under strata may with certainty be discovered; and though it should already contain water, a cut may be made to take it off, with what is let down from above; at the point marked K, in the section of plate No. VI.

It frequently happens, that springs, or *spouts*, as they are sometimes called, rise in the middle of a field, at a distance from any ditch or open drain into which they may be led; so that a covered drain, brought from the nearest outlet, would pass so far through dry ground, as to make the expense of conducting the water from the spout greater than the injury done by it. To remedy this, the water may be cut off by a drain along the upper side of the spout, and led into a pit sunk through the clay; or, where the retentive stratum is not deep, the drain across the spout may either be cut through this substratum to the porous one below, or bored through, to let the water escape downwards. But, if the ground is steep, and the stratum into which the water is let down terminates at the surface, somewhere lower down on the declivity, the water will again burst out, and form a similar

spout, or wet place, in that part of the field.* This, however, may seldom happen, and may be easily remedied, being near the extremity of the field.

In Dr. Nugent's Travels through Germany in 1766, and in the Agricultural Report of the county of Roxburgh, an account is given, of similar modes of draining ground in a land-locked situation, of which, as they prove the practicability of that method, the following extracts are given:

Dr. Nugent says—"The draining of marshes is conducted in much the same manner as that of lakes; but here I have seen the operation only performed on what we call moor or turf grounds. These are most easily drained by carrying trenches through those grounds, when the disposition of the country is such that the water can be conveyed to some neighboring stream. The first thing they do, is to carry a ditch to the middle of the moor in a direct line, its depth and breadth adapted to the extent and wetness of the ground, and thus to the supposed quantity that is to be carried off. Every six, eight, or ten perches, as the ground is more or less swampy, cross trenches on both sides are drawn in a direct line, and communicating on both sides with the main trench. But, in case of water coming from any neighboring eminences, they dig a trench round the whole ground as a reservoir; and this likewise communicates with the main trench, &c. In case the draining of the water into some natural receptacle be not practicable, at least not under a very great expense, then they have recourse to sinking ponds or reservoirs in some neighboring bottom, and to these they carry all the trenches. It is the nature of moors in general, that, beneath the turf or moss, there is a loam which hinders the moisture from penetrating; and this indeed is what makes the marsh, and causes the luxuriant growth of the turf or moss; but this loam or clay is only a stratum, and far from being of an immense depth; under it is generally a sand, or some other stony or loose soil. Here reason readily informs us, that a middling morass may be drained, *by perforating the clay*, and thus making way for the moisture to penetrate. In order to this, a pit is dug in the deepest part of the moor, till they come below the obstructing clay, and meet with such a spongy stratum, as in all appearance will be sufficient to imbibe the moisture of the marsh above it.

"Into this pit, the ebbing of the morass is conveyed through a trench, and both the trench and the pit are filled up with large broad stones, setting them edgewise, so as to leave interstices for carrying off the water: then such stones are laid over breadthwise, and covered with loose earth, like that on the surface. This is a matter of no great expense, the pit being as near the morass as the water will admit, and the trenches but short: thus they have a drain unperceived, which leaves the surface of the trenches for the plough; and in middling marshes, especially in such moors as are only wet and damp, this method, though sometimes slow, never fails taking effect; and many tracts are thereby made serviceable to the farmer or grazier."

In the Roxburghshire Report, it is thus stated: "In the first place, it will be necessary to premise, that from one to six feet deep, below the surface of the waste lands that might be made arable in this county, is found a large seam of black slaty or metallic substance, generally from twenty to twenty-five feet in thickness; and below this is found a mass of whinstone rock, both lying in a tolerably regular straight line. The thickness of the whinstone rock, I presume, is unknown, as I have not heard it was ever bored into. The black slaty or metallic substance is generally found so closely cemented, as it were, without chinks or fissures, that it is impenetrable to water or any other liquid; while, on the contrary, the whinstone rock, when come at, abounds with chinks and fissures, and will receive and swallow up any quantity of water poured into its bosom. The surface of the earth, above the slaty or metallic substance, is every where of a light, kernelly, and mossy nature, apparently having, in the course of ages, been produced and formed from the vegetable substances which had attached themselves to it: falling in the autumn seasons, and having no receptacle to receive the rain-water as it falls below this stratum, it preserves it on its surface, and in the winter months becomes swelled and enlarged in a considerable degree. In the spring months, when the sun and wind exhale it, the moss becomes of a tolerable firmness, and produces a coarse kind of unprofitable grass, mixed in many places with short heather, of no use either for the rearing or feeding of sheep or cattle.

"Having, in a brief manner, thus given an account of the several strata of which the waste land of this county is composed, which every person in the habit of improving should be well acquainted with, I shall now proceed to give an example or two of the method of cultivation I took, and then add a few observations. In the latter part of October, I ploughed up twenty acres of waste land of the above description; and as one part of it lay nearly on a level, and the other on the slope of a hill, I divided it into two parts, judging it might be necessary to cause each part undergo a different course of cultivation. The level part I gathered up in small ridges, and ploughed it pretty deep, making the furrows narrow, keeping two laborers following each plough, as well to remove any obstructions that might arise from stones or roots, as also to turn the upper rim or surface below, when the plough was in fault. This done, I allowed it to lie till midsummer following; but, in the spring months, as soon as it would bear my sheep and cattle, I drove them up and down the ground, as often as occasion would permit, as well to nip off any sprouts of grass that might appear, as to tread it to a firm consistence, and which was attended with most beneficial effects. At midsummer, I gathered it up again; but finding, although the ridges were getting high, being only set out eight feet at first, the plough did not get to the slaty substance in the hollow of the ridge, I was obliged to lay out the ridges sixteen feet. This cost me a deal of trouble, but I eventually got the plough down to the slaty substance. When my work was done so far, my next thoughts were directed, how to get the water drawn out of the hollow of the ridges, being at least four feet below any level I could obtain. To remedy this, I got a pair of bore-rods, which I put down through the slaty substance, to the whinstone rock, at sundry places, and which effectually answered my purpose, keeping the tops of the holes covered with a basket of

*The author has seen several instances of this in the course of his practice.

loose stones, which I allowed to remain, or removed at pleasure, as the weather proved more or less wet. In the spring following, I had the pleasure to find my waste land was in a condition to sow, as early almost as any other part of my farm: the winter rains falling through the soil upon the ridges, into the bosom of the slaty substance, which was laid bare in many places in the hollow of the ridges, it was gently drawn off, and glided regularly into the holes or canals which I had made."

In the Agricultural Report of Hertfordshire, it is also stated, that land has been drained, by perforating the retentive stratum in the manner that has just been described; but the detail is too long to be inserted here.

SECTION X.

Drainage of low flat ground, without any practicable fall or outlet.

The most expensive of all modes of draining is, (where no natural fall or outlet can be found,) by superinduction or compression; as has been done on the ground that was formerly the site of the North Loch, between the old and new towns of Edinburgh. The situation and substrata of this ground being different from that treated of in the last section, another mode must be adopted. The first thing to look to in this case is, to the nearest place where material may be got to fill up, to the required height, the surface of this low ground, which it is wished to raise above the influence of the water. Indeed, the whole depends on this, and whether the expense of transporting it to the place where it is to be deposited, will be repaid by the value of the ground when thus raised above the wet level. The operation itself is simple. The first layer or artificial stratum should be stones or any loose matter, gravel, or sand, as a reservoir to retain the moisture so far below the surface as to prevent any injury from it to the crops, or to the pasture, that may be produced on it. It will also be necessary to make a drain of outlet from the surface to the lowest practicable level, in case of injury from rain-water, which it may be apt otherwise to retain. In short, no further specific directions need be given; only, in depositing the different layers of stuff, to raise it to the proper height, the best must be reserved for laying on the surface.

Such draining, or rather superinduction, can only be useful in cases like that of the North Loch just mentioned; where the object is something more than that of making it dry for the sake of a money profit; and where it may be injurious to the health of those living near it, by the noxious vapor and miasma which arise from such stagnant wetness, particularly in closely inhabited localities, and in the vicinity of towns, &c.

SECTION XI.

On draining by the plough, and the proper formation of ridge and furrow.

The invention of any means by which labor may be diminished and expense lessened, is an object desirable in every mechanical process, and has always been liberally rewarded when found to be useful. In the various branches of manufacture, machinery has been invented to facilitate the operations, and to lessen the necessity of manual labor; and the thrashing machine has been found so useful in that department of husbandry, as to be successfully introduced into every part of the kingdom. It is imprudent, too hastily to prescribe a limit to human invention; but the probability of an *effective hollow draining plough*, to work so much cheaper than the spade, as to render it an object of economy, is not very flattering. There can be no difficulty of making one to prepare for the narrow draining spade, where surface drains of no great depth are required; but beyond that the attempt would be fruitless. Various ploughs, indeed, have been invented, and premiums given to the inventors; but all, or most of them, have been found deficient, and have been therefore laid aside. From the number of horses or oxen required to work them, ploughs calculated for this purpose are more expensive than the spade, and never can come into general use. In lawns and smooth pastures, where only *grips* or small surface-drains are useful, the common draining plough may be employed with advantage; but in soils that are strong, and where a greater depth is necessary, the interruptions that would be met with are insurmountable. The method followed by some good farmers, who do not possess ploughs constructed on purpose for such work, is this: With their common plough drawn by four horses, they turn a double furrow, about six inches deep, throwing the earth on each side, and leaving a *baulk*, or space untouched, in the middle. This baulk they remove by a second *bout* or turn, in the same manner; they then go in the wide furrow or space thus opened, twice with their common double-breast plough, getting what additional depth they can. After this, they remove, with a spade or shovel, all the loose mould, so as to smooth and form the bottom to about a foot in breadth; and thus having gained more than a foot in depth, according to the soil, and strength of the plough, they dig one portion with the draining spade, sixteen inches deep, and after that another of twelve inches, making in the whole a drain forty inches in depth, two feet wide at top, and very narrow at bottom. This is filled with stone or brush-wood, as comes most readily to hand, and forms a cheap and useful drain in certain soils and situations.

The ploughs called the *miner* and *mole-plough*, as also a machine of cast-iron, in form of a wheel, are used in several parts of England, and said to answer well; but as they have not been introduced into general practice, drawings or descriptions of them, are here unnecessary.

It has been already observed, that on some soils, where the surface is flat and very retentive, no number of covered drains can operate effectually in keeping it dry. In such land, therefore, much may be effected by a proper formation and direction of the ridges and furrows. Much has been written against high ridges, without consideration of their propriety; and because they have been applied on dry soils absurdly, and being the custom in some parts of the country, no discrimination has been made; but their being improper in some cases, and ill managed in others, affords no just argument against them, when adapted to the soil and wetness of the climate. One objection, indeed, and that not a slight one, against raising ridges too high, is, that the rain falling, washes off more easily the finer particles of the soil and manure from the sides into the furrows, in which it is carried off the field; and that

the seed cannot be so equally sown, and may be drawn into the furrows by the harrowing; and it likewise renders cross-ploughing more difficult. In many instances ridges are laid too broad and flat, and the furrows neither properly directed, nor of sufficient depth. By this means, water stagnates both on the ridges and in the furrows, which, in wet seasons, makes the ploughing laborious, and proves injurious to the crop. In the carses of Gowrie and Stirling, as has already been observed, the practice of having the ridges of a proper breadth, enough, but not too much rounded, and the furrows in such a direction, and of such depth, as to carry off readily all surface water, is now so much more attended to than formerly, that their present fertility has been very much advanced by these means. The simple operation of water-furrowing is attended with such beneficial consequences, that wetness may often be removed by that means alone, without the aid of drains, and where the omission of it frequently causes the loss of part of a crop. Water-furrowing also is of great use in pasture fields, where, by scouring out and clearing the furrows before winter, the water is prevented from lodging, and soaking into the soil, making it easily poached; and chilling the roots of the grass, renders it later in coming forward in spring.

PART. II.

ELKINGTON'S MODE OF DRAINING.

SECTION. I.

Brief account of the discovery by Mr. Elkington, and principles of that system.

The author having, in the summer of 1796, accompanied Mr. Elkington on a tour through those counties of England, where he was executing the most remarkable drainages at the time, had, in the course thereof, an opportunity of examining the farm and field, in which he first made the discovery of that particular mode of draining, which has since been so successfully practised, both in that country and in Scotland; and was enabled to lay before the public, by means of the Board of Agriculture, an 'Account' of the whole system, which was published in the year following. As doubts were entertained by many, of the origin of that discovery, and its merit was claimed by the late Dr. James Anderson, the author of many ingenious and useful publications on husbandry, a detail of its particulars, with the explanatory plan (copied on next page), was given in the 'Account' alluded to. This set the public mind at rest with regard to the merits of that claim, and put a stop to all further controversy on the subject. The author having carefully perused Dr. Anderson's work, where the subject of draining is treated of, which was published in the year 1775, acknowledges the merits of the Doctor's claim, so far as it is founded on similar principles; but, as to its priority, the following narrative will briefly explain the fact. In the year 1763, Elkington was left by his father in the possession of a farm called Prince-Thorp, in the parish of Stretton upon Dunsmore, and county of Warwick. The soil of this farm was so poor, and in many places so extremely wet, that it was the cause of rotting several hundreds of his sheep, which first induced him, if possible, to drain it. This he began to do in 1764, (consequently ten years prior to Dr. Anderson's publication), in a field of wet clay soil, rendered almost a swamp, or *shaking* bog, by the springs which issued from an adjoining bank of gravel and sand, and overflowed the surface of the ground below. To drain this field, which was of considerable extent, he cut a trench about four or five feet deep, a little below the upper side of the bog, where the wetness began to make its appearance; and after proceeding with it in this direction, and at this depth, he found it did not reach the *principal body of subjacent water* from which the evil arose. On perceiving this, he was at a loss how to proceed, when one of his servants came to the field with an *iron-crow* or bar, for the purpose of making holes for fixing sheep-hurdles, in an adjoining part of the farm, as represented on the plan. Having a suspicion that his drain was not deep enough, and desirous to know what strata lay under it, he took the iron bar, and having forced it down about four feet below the bottom of the trench, on pulling it out, to his astonishment, a great quantity of water burst up through the hole he had thus made, and ran along the drain. This led him to the knowledge, that wetness may often be produced by water confined farther below the surface of the ground than it was possible for the usual depth of drains to reach, and that an *auger* would be a useful instrument to apply in such cases. Thus chance was the parent of this discovery, as she often is of other useful arts; and fortunate it is for society, when such accidents happen to those who have sense and judgment to avail themselves of hints thus fortuitously given. In this manner he soon accomplished the drainage of his whole farm, and rendered it so perfectly dry and sound, that none of his flock was ever after affected with disease.

By the success of this experiment, Mr. Elkington's fame as a drainer was quickly and widely extended; and after having successfully drained several farms in his neighborhood, he was at last very generally employed for that purpose in various parts of the kingdom, till about thirty years ago, when the country had the melancholy cause to regret his loss. From his long practice and experience, he became so successful in the works he undertook, and so skilful in judging of the internal strata of the earth, and the nature of springs, that, with remarkable precision, he could ascertain where to find water, and trace the course of springs, that made no appearance on the surface of the ground. During his practice of more than thirty years, he drained, in various parts of England, particularly in the midland counties, many thousand acres of land, which, from being originally of little or no value, soon became as useful as any in the kingdom, by producing the most valuable kinds of grain, and feeding the best and healthiest species of stock.

Many have erroneously entertained an idea, that Elkington's skill lay solely in applying the auger for the *tapping of springs*, without attaching any merit to his method of conducting the drains. The accidental circumstance above stated gave him the first notion of using an auger, and directed his attention to the profession and practice of draining, in the course of which he made various useful discoveries, as will be afterwards ex-

Plan of Long Harol Pits, part of the farm of Prince-Thorp in Warwickshire,

Being the field in which Mr. Elkington first discovered his mode of draining, A. D. 1764.

Plate VII.

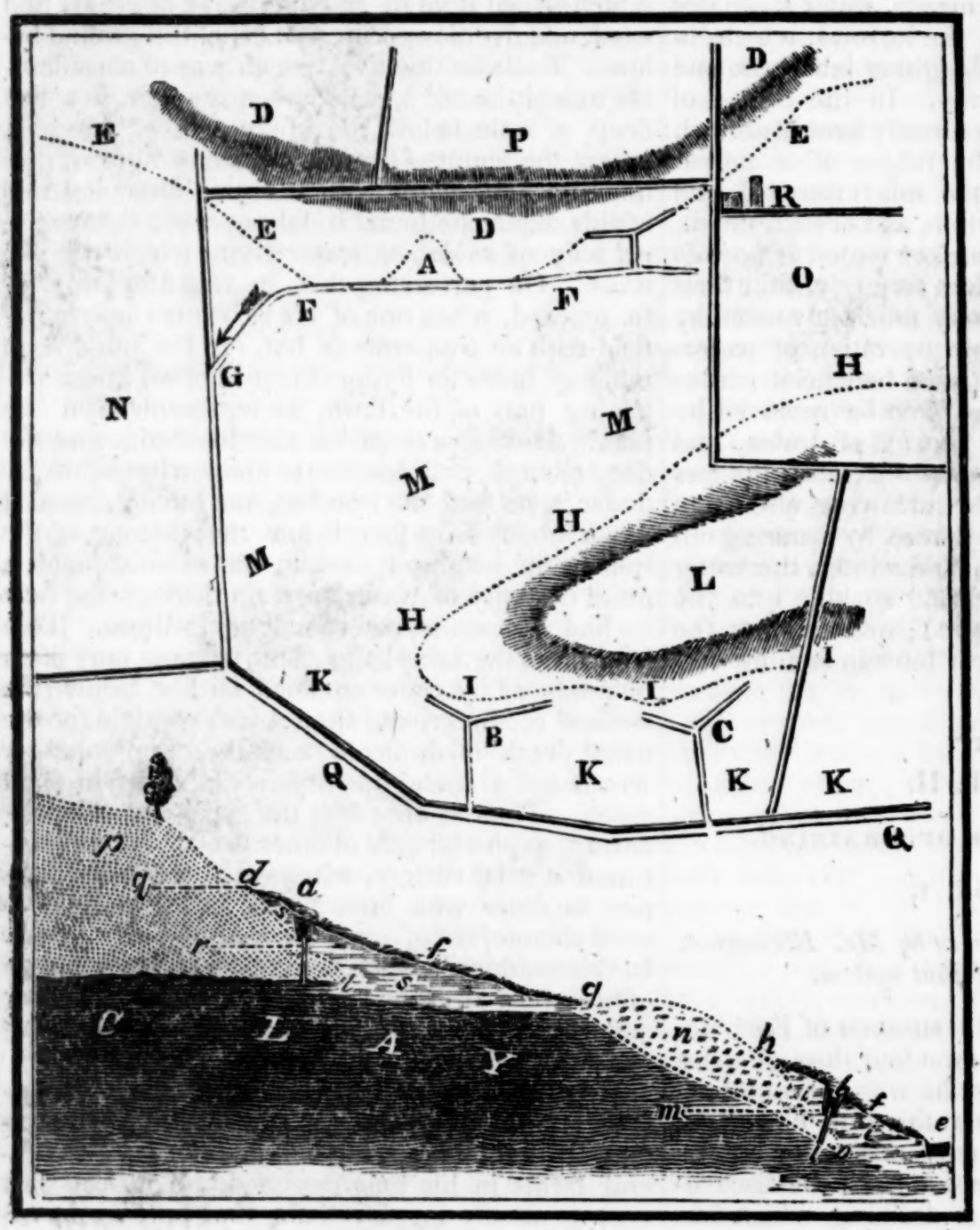


Fig. 2. Section.

p Gravel and sand.—*a* Upper drain at A in fig. 1.—*b* Lower drains at B and C in fig. 1.—*d* Outlet of the springs (before draining).—*e* Ditch.—*f f* Wet boggy surface covered with rushes.—*g* Where the water was drunk in by the rock.—*h* Where the water again broke out of the rock.—*i i* Clay and peat.—*l* Auger hole.—*m* Level of the outlet.—*n* Porous rock with dry surface.—*q* Upper level of the water.—*r* Level of the drain's bottom.—*s s* Clay and peat.—*t* Tail of the sand.

Fig. 1. *Horizontal Plan.*

P Field that was in turnips at the time Mr. Elkington was cutting the first trench, and to which the man was going with the iron bar, with which Mr. E. first discovered the spring.

D D D Gravel and sand bank containing springs.

E E A E Line along which springs broke out, before the drain was cut.

M M M Clay, boggy and covered with rushes, caused by the overflowing of the springs in the gravel and sand above the upper trench.

H H H Here the water of the springs was absorbed by porous rock, after flowing over the surface of the clay.

L Dry ground above the porous rock.

I I I Lower side of the rock, where the water again broke out.

K K K K Clay, boggy and covered with rushes, caused by the water flowing from the rock.

O The ground here also affected by the drains in the adjoining close, the same strata lying across it.

N Ground here also affected.

A The place where the clay pointed up on the surface above the line, and below the bottom of the trench; the depth of which not reaching the spring, induced Mr. Elkington to push down the iron bar; which at four feet below the bottom of the drain caused the water to burst up; and this was the first means that led him to think of applying the auger as a more proper instrument in such cases, where the depth of the drain does not reach that of the spring; and upon this, all his future practice is grounded.

F F First drain or slough made by Mr. Elkington, which entirely cuts off the springs, and prevented their overflowing the clay surface.

G Orifice of the drain where the water is discharged into the ditch G Q Q.

plained, With regard to the use of the auger, though there is every reason to believe that he was led to employ that instrument from the circumstance already stated, and did not derive it from any other source of intelligence; yet, there is no doubt that others might have hit upon the same idea, without being indebted for it to him. It has happened, that in attemps to discover mines by boring, springs have been tapped, and ground thereby drained, either by letting the water down, or by giving it vent to the surface; and that the auger has been likewise used in bringing up water in wells, to save the expense of deeper digging; but that it had been *used in draining land, before Mr. Elkington made that discovery, no one has ventured to assert.* That it was used in Italy, for the purpose of procuring water in wells, appears from Buffon, who in his Natural History, states, "that in the city of Modena, and four miles round, whatever part is dug, when we reach a certain depth, and then *bore deeper with an auger*, the water springs up with such force, that the well is filled in a very short space of time. This water flows continually, and neither increases nor diminishes by the rain or drought." It is not probable, however, that Elkington received any hint from this, or any other publication in the English language, as Dr. Nugent's Travels in Germany were printed in the year 1768, and Dr. Anderson's Essays were not published till 1775; whereas his discovery was made in 1764.

Draining, according to Elkington's principles, depends chiefly on *three* points:

1*st*, Upon discovering the main spring or source of the evil;

2*d*, Upon taking the level, and ascertaining its subterraneous bearings; and,

3*dly*. By making use of the auger to reach and *tap* the springs, when the depth of the drain is not sufficient for that purpose. The nature of springs, and the causes of wetness, have already been explained in Section II, of Part I.

The first thing, therefore, to be observed is, by examining the adjoining high grounds, to discover what strata they are composed of, and then to ascertain, as nearly as possible, the inclination of these strata, and their connection with the ground to be drained; and thereby to judge at what place the level of the spring comes nearest to where the water can be cut off, and most readily discharged. The surest way of ascertaining the lie or inclination of the different strata, is, by examining the bed of the nearest streams, and the edges of the banks that are cut through by the water; and any pits, wells, or quarries that may be in the neighborhood. After the *main spring* has been thus discovered, the next thing is, to ascertain a line on the same level, to one or both sides of it, in which the drain may be conducted, which is one of the most important parts of the operation, and one, on which the art of draining, in a scientific manner, essentially depends.

Lastly, The use of the auger, which, in many cases, is the *sine qua non* of the business, is to reach and tap the spring when the depth of the drain does not reach it; where the level of the outlet will not admit of its being cut to a greater depth; and where the expense of such cutting would be great, and the execution of it difficult.

According to these principles, this system of draining has been attended with extraordinary consequences, not only in laying the land dry in the vicinity of the drain, but also springs, wells, and wet ground, at a considerable distance, with which there was no apparent connection.

SECTION II.

*Its particular application to spring bogs.**

The draining of large tracts of bog or marshy ground, injured by springs, forms a part of this system, deserving of the greatest attention, and is, in every point of view, the most important. Many extensive tracts of ground of this description are at present lost to every useful purpose to which they might be converted, from the mistaken notion of those to whom they belong, that their nature is such, as either to render them incapable of being drained, or that it is only possible at an expense greater than their value. However impracticable the draining of such bogs may appear, yet by attention to the proper mode of doing it, their drainage may be easily effected, and at little expense; and, when made dry, they become the most valuable of any. Their cause and formation have already been explained. They may be divided into two classes, according to their situation, and the different mode of draining that applies to each. Those of the first class are easily distinguished by the springs issuing from the adjoining higher ground, in a regular line, along the upper side of the wet surface. The second class of these bogs has the appearance of being still more difficult to drain, although, in several respects, they are less so than the former.

In these last, the many springs that break out are not confined to a regular line along the upper side, as represented by Plate No. VIII., but burst

* So called, in contradistinction to such as are wet and boggy from *surface* water alone; and also to such *peat bogs* or mosses, as do not derive their origin from springs.

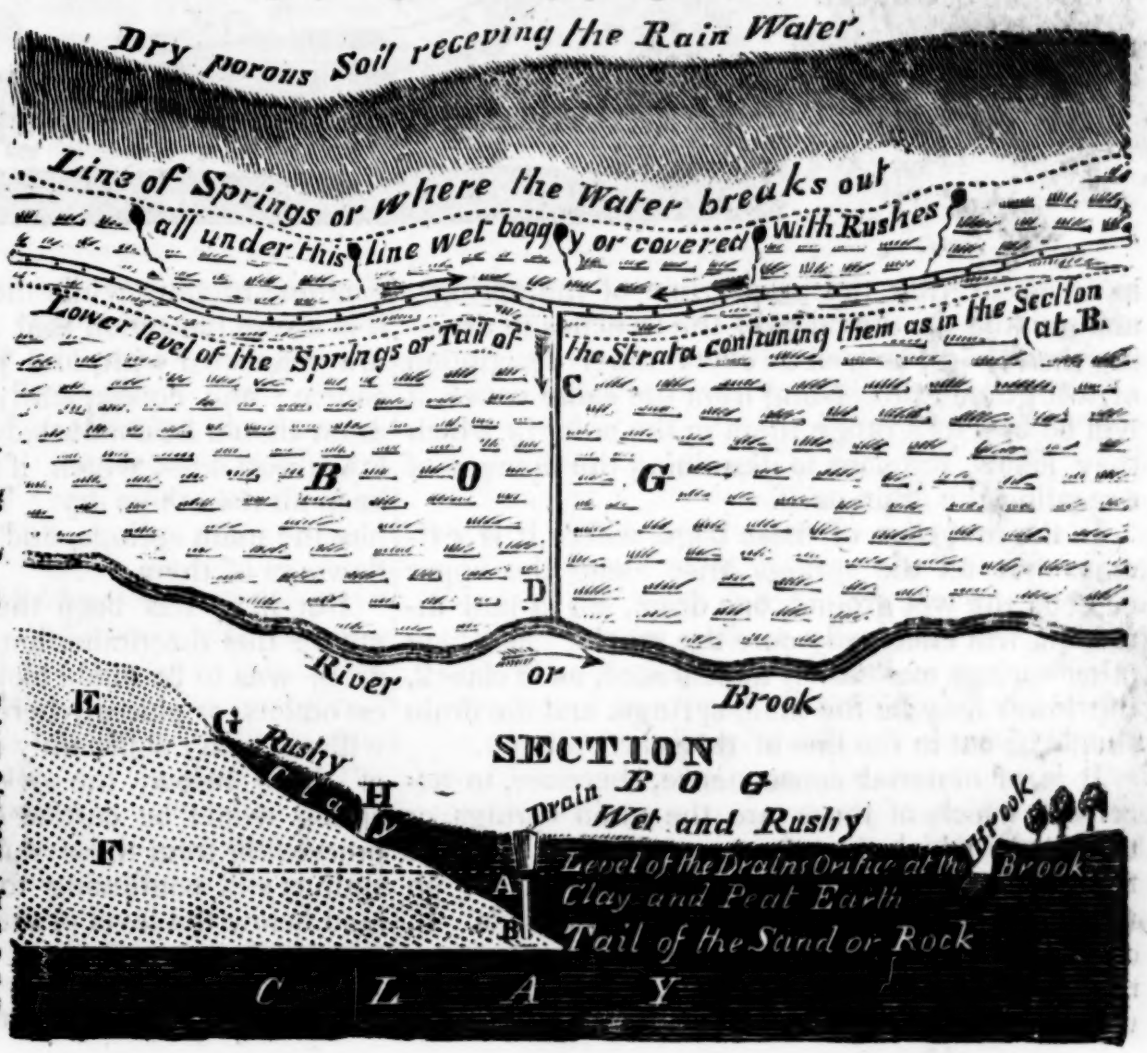
PLATE VIII.—*Drainage of Bogs caused by springs.—Class 1st.*

Horizontal Plan.

Section.

C D Drain for carrying the water to the nearest outlet.
E Dry porous, soil receiving the rain water.
F Gravel, sand, or porous rock, containing springs.
G Where the water breaks out when the springs are full.
H Outlet of the spring.

If the stratum of Clay where the trench is cut be thicker than the level of the outlet will admit, the depth of the drain to be (A representing the depth of it, at that level,) the remaining part of that clay from A to B must be perforated by the auger to the tail or lowest point of the sand or rock at B, when the spring will immediately rise up into the trench, by the pressure of its water above the drain's level.

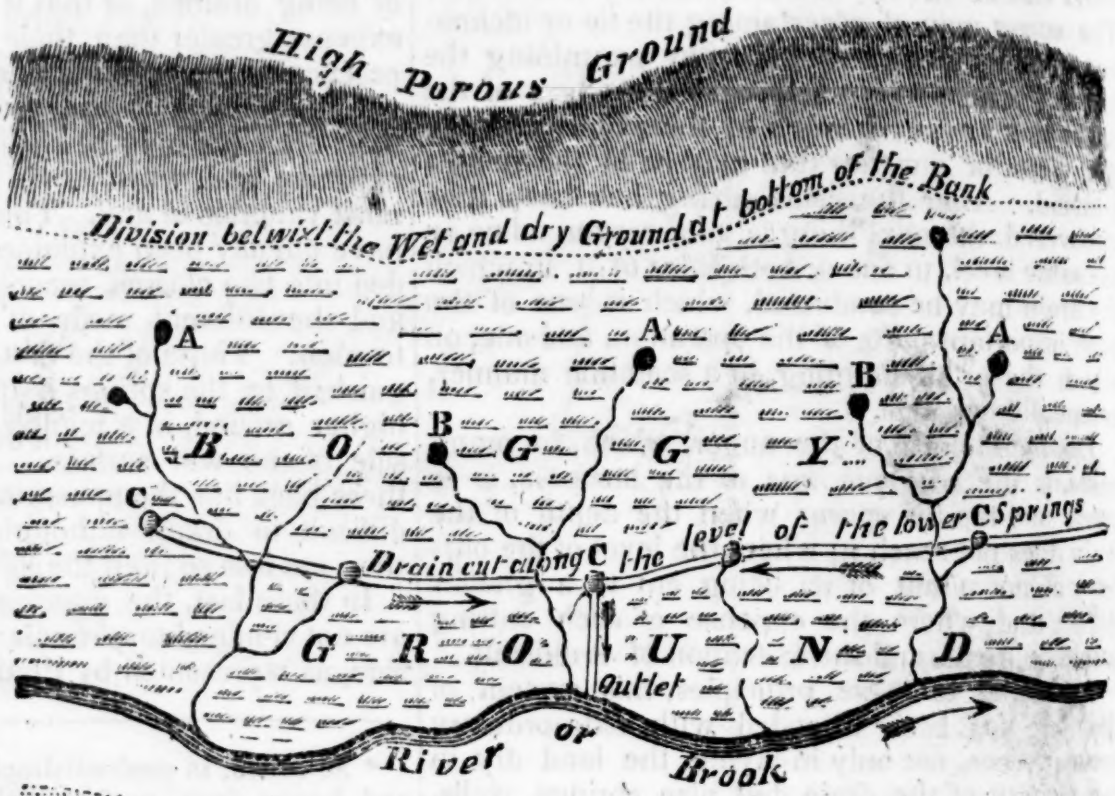


out promiscuously over the whole surface, forming *quagmires* that shake all around, over which it is dangerous for the lightest cattle to pass, and which show themselves at a distance, by the verdure they produce. Of this grass, which is luxuriant even in winter, sheep are remarkably fond, and, devouring it greedily, never fail to be attacked with the *rot*. Under the moss or peat earth, that, for ten feet or more, forms the upper part of these bogs, is found a bed of clay, (seldom of great depth), below which there is generally a stratum of sand, gravel, or rock, according to that of which the adjacent eminences are composed. The clay immediately above this, and between it and the peat, being in many places thin, and in some degree porous, the constant pressure of water, contained in the high grounds above, forces that under the bog (with which it is connected), through these more porous parts of the clay and peat, where it bursts up, forming those appearances just described, as represented by Plate No. IX. As there are a variety of circumstances to be attended

PLATE IX.—*Draining of Spring Bogs.—Class 2nd.*

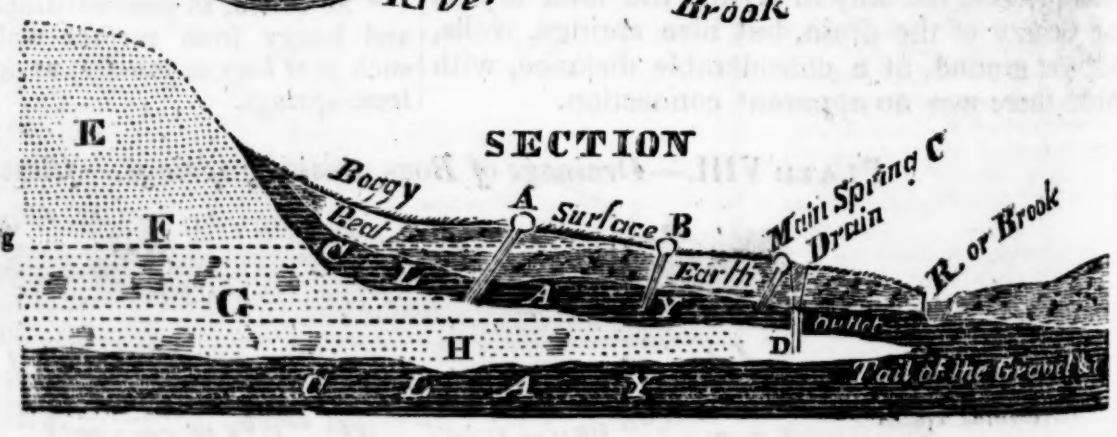
Horizontal plan.

A A A, B B B, C C C Springs.



Section.

A B and C Springs.
D Auger hole.
E High porous ground.
F Upper level of the water.
G Level of outlet.
H Gravel of sand containing springs.



to, in discovering the proper line of the springs, and guiding the direction of the trenches in draining these bogs, as well as every other description of wet ground proceeding from the same cause, it will be best to arrange them in the order in which they follow, previous to describing the manner of executing the drain itself.

In the first class of these bogs, where it is evident that all the springs arise along the upper edge of the wet ground, one drain, cut in that direction, will effectually cure the whole; but where other springs make their appearance, as in class 2, the lower may be the main springs, and the drain should be cut in the line of these accordingly.

It is of material consequence, therefore, to ascertain which of these are the main springs, or those from which the others are supplied; and it is therefore one of the principal circumstances on which the true direction of the drain depends. If, on the surface where the different springs appear, they break out at different levels, according to the wetness of the season, and those lowest down continue running while those above become dry, it is a sure indication that all the different outlets are connected with, and proceed from, the same source; and consequently, that the line of the drain should be conducted along the level of the lowermost ones, which, if properly executed, must keep all the others dry. These lower are therefore the main springs, and those above, the overflowings of them.

But if, as has been the too frequent practice, where this discrimination is not attended to, the drain was to be made along the line of the highest outlets, or places where the water breaks forth, without being sufficiently deep to reach the level of those below, the overflowings only of the spring would be carried away, and the wetness proceeding from these removed; while the main springs still continuing to run, would render the land below the level of the bottom of the drain, as injuriously wet as before.

[To be continued.]

From the proceedings of the Agricultural Society of Albemarle, Virginia.

ON THE USE OF OXEN.

Extract of a letter from George W. Erving, esq., late minister at the court of Madrid, to a committee of the society, dated at Paris, July 15th, 1819.

(Read, May 8th, 1820.)

I noticed in the very interesting address (of May, 1818,) to your society by Mr. Madison, a recommendation to encourage the use of oxen in preference to horses, for agricultural labors.—As oxen are very generally used in the greater part of Spain, I was induced, by the president's observations, to examine, as far as I could, into the estimates made in that country of the superiority of those animals, and in the course of my inquiries met with a small work containing a great deal of important matter, and some curious details and calculations, fully justifying the preference which ought to be given to them. I beg leave herewith to offer it to you, persuaded that you will have much satisfaction in the perusal of it, and that if the society be disposed to adopt the ideas of the president, you may very much promote the object, by causing to be translated and laying before it, if not the whole, the most interesting passages of this little work, which as far as I can find, is the only one of any merit on the subject which has hitherto appeared. You will observe, that the writer insists upon the still more general use of oxen in Spain, as well as on the substitution of horses for mules in those labors where oxen cannot be so advantageously employed. Though a great part of his argument is founded upon circumstances peculiar to Spain, and all his calculations will not therefore apply to all countries, nevertheless there is much general reasoning which is applicable to every country where agricultural economy is studied; and which, as appears to me, will tend very much to establish a preference of horned cattle over horses and mules in the United States. I say "horned cattle," because, as you will notice, the cow in Spain bears her proportion of the labors of the field, even during the time of her pregnancy.

All that I have otherwise learnt from the most intelligent persons in this matter, goes to confirm the view taken of it by Mr. Madison. Oxen may not only be kept in full strength without grain, but in Spain on straw principally; perhaps the straw there, has more saccharine juice in it than ours. But may not our corn-stalks be a substitute for, or even a better nourishment than straw? As to the tractability of the animal, the president has fully answered the objections ordinarily produced, and it may be added that the ox, when once subdued, is always to be depended on, whereas, the horse, when high fed, or after a long repose, is likely to have accesses of disobedience. That the ox may be used singly with a proper harness, as the president says, is abundantly proved in Castile, where nothing is so common, as to see in the light lands a single ox or a cow between a pair of small shafts. The superior celerity of the horse is amply compensated by the other qualities of the ox; this last ploughs more steadily and deeper; the horse's vivacity jerks the plough out of the ground, and for the very reason that he is lighter, he vacillates more in the direction that he takes; whereas, where the ox plants his foot, his weight fixes him, and as his legs are short, and his head is always carried low towards the ground, he cannot well deviate from his right line. In this way he will plough a "fanega" (somewhat less than our acre) per day; horses and mules will plough a fanega and a half, but not so deeply, or so well done. The ox works in the field from dawn till the heat sets in, about 11 or 12; he then reposes, eats, and ruminates for three hours, after which he works till night-fall. Some persons give him two spells of repose, but that is considered as a bad method. For the field service, it is not necessary to shoe him: on the road, his shoes last a long while, and cost only about forty cents.

Mr. Madison seems inclined to allow, that the ox is less fit for the road service, than the horse or mule. As to the disadvantage which belongs to his movement, and to the form of his hoof, in a frozen road, I suppose that the objections must be considered as solid; but in a sandy or muddy road, (not frozen,) the broadness of his hoof, as well as its cloven form, is a manifest advantage. On the roads of Castile, which are dry and hard, oxen will go with loaded wagons, a league in two hours; horses go the same distance in an hour and a half. Their usual day's journey is from four to five leagues, when the weather is not too hot; but though certainly the ox suffers more from heat than the horse, yet, it is found in Spain that this disadvantage is counter-balanced, by his exemption from numerous disorders to which the horse is subjected; and perhaps the greater number of accidents to which he is exposed, ought also to be taken into the account.

Allow me to offer to you my best wishes for the success of your patriotic institution, and assurances of the very great respect, with which

I am,

Gentlemen, your very ob't. servant,

GEORGE W. ERVING.

To J. A. Coles,
Tho: M. Randolph,
P. Minor, esquires.
} *A committee of the Agricultural Society of Albemarle, in Virginia.*

From the Plough Boy.

FLEMISH HUSBANDRY.

To the Editor of the Plough Boy:

Sir—Much has been said in praise of English husbandry, yet it is a well known fact, that this vaunted system is surpassed in many countries which do not possess equal natural advantages. In Scotland, agriculture has progressed at least half a century beyond that of England, where the soil and climate is far more congenial to the productions of the earth than the "bleak mountains of Caledonia." But no where in the world is the contrast so marked as that between the Flemish and English mode of cultivation.

The average produce of a crop of wheat in England, is twenty-four bushels per acre. In Flanders, it is thirty-two bushels. In England, the system of *fallows* almost universally prevails. In Flanders, it has been unknown from time immemorial; two crops, in many cases three, being uniformly raised annually upon the same field. The following comparative tables, as exhibited in 'Vanderstraeten's Sketch of the Flemish System,' show clearly and correctly its superior advantages over that of England:

Produce of the Flemish farmer from one acre, for 12 years.		*Produce of the English farmer, according to the Norfolk course, for the same period:*	
Wheat, 32 bushels per acre,	4 crops	Wheat, 24 bushels per acre,	3 crops
Barley, 60 bushels per acre,	4 do.	Barley, 32 bushels per acre,	3 do.
Flax, hemp, cole-seed and potatoes,	4 do.	Turnips,	3 do.
Roots and vegetables for the food of cattle,	10 do.	Clover,	3 do.
In 12 years,	24 crops	In 12 years,	12 crops

This immense difference in favor of the produce of Flanders, does not arise, as might be supposed, from its possessing a better natural soil, or a milder climate than England, but entirely from the different mode of cultivation pursued in these two countries. At no very distant period, the fields of Flanders, now so productive, were little else but loose sand and gravel, whereas, the soil of England was always naturally fertile, and in part, lies under a more southerly parallel than Flanders.

The rich, abundant, and healthy crops obtained by the Flemish farmers, may be traced to the following causes:

1. The abundance and judicious application of manure. 2. Digging all the lands on their farms with the spade, every six or every three years. 3. The complete extirpation of weeds and noxious roots. 4. Regular and repeated hoeing. 5. A careful choice, and alternation of grain and seeds for sowing. 6. An improved rotation of crops.

"The whole secret, (observes Vanderstraeten,) respecting the superiority of Flemish agriculture, consists in this: the farmers procure plenty of food for their cattle—food which, excepting clover, is raised from the same lands, which have already yielded their crops of grain, &c. They keep the greatest possible number of cattle, feed them in the stables plentifully, and render their food palatable. They collect the greatest possible quantity of manure, of which they preserve the fertilizing salts by a suitable process of fermentation. They weed their grounds thoroughly and repeatedly. They totally extirpate noxious plants and roots, every six or every three years, by digging all the lands on their respective farms—an operation by which they revert to the surface a stratum of fresh soil, that for three or for six years has been absorbing the salts of manure as they filtrated to the bottom of the roots; a stratum of soil which has produced no crop during the same period. They, moreover, dress their grounds to the precise point of perfect pulverization. These are inestimable advantages, which cannot be obtained by any plough whatever: hence, the drift of the Flemish adage—"Never to let the naked ground lie open to the sun in summer for more than three days."

"In truth, to say that there exists a vast province, in which the price of lands has been quadrupled within fifty years, and which is neither placed under a more favorable climate, nor enjoys a greater fertility of soil than England; from which fallows in general have been banished from time immemorial; in which the greater part of the lands produce in nine years at least fifteen harvests, of which, those of grain, yield one year with another, as high as thirty-two bushels of wheat per acre, those of barley, sixty bushels, and those of oats, ninety bushels; and where the borders of the fields are planted with trees in such numbers, that by their sale the proprietors acquire, every forty years, a sum of money equal to the soil; to say this, appears, to other than Flemish readers, to repeat a tissue of fables.* The less informed, attribute this uninterrupted succession of harvests to the inexhaustible fertility of the soil; but intelligent and well informed travellers attribute it, on the contrary, and with the best reason, to the indefatigable industry of the inhabitants, and to a highly improved mode of culture, of the details of which they are themselves ignorant, and which beside, from their complication, and the great variety of the productions of the soil, require a profound study, of many years duration, to which few of them have either the inclination or the leisure to apply."

This correct, though "bird's eye" view, of Flemish husbandry, merits farther amplification, in order to furnish distinct data to the intelligent and enterprising agriculturist. My subsequent communications will be directed to that subject.

Respectfully, yours,

GEO. HOUSTON.

New York, April 18, 1820.

FLEMISH HUSBANDRY.—No. 2.

Sir—I shall now, as promised, give some details, respecting the Flemish mode of cultivation.

1. *Manure.*

A Fleming spares no cost† nor labor to obtain this necessary article. What his domestic arrangements do not produce, he supplies in the neighboring towns and villages; but it is chiefly upon his cattle that he relies. Of these, he rears an immense number: five times more in proportion, than is done by the English farmer, by which he obtains at least triple the quantity of dung. He is equally careful to preserve the *liquid* portions of this manure, which contain the greatest proportion of fertilizing juices. For that purpose, the stalls and stables where the cattle are kept, are paved with a cement impervious to water; a precaution, by which no part of the urine of the animals is lost; while dung pits, to which there is a communication by little channels from the cattle-stalls and privies, are formed and

*In Flanders, wheat yields 20; rye, 26; barley, 26: and oats, 40, for one. Wheat holds only the fifth rank in value in the harvest of Flanders. In England, wheat never yields more, on an average, than 10 or 11 for one; barley, something less than ten to one; and oats only between eight and nine for one. In some highly ameliorated farms in the county of Suffolk, Arthur Young reports a produce of 36 bushels of wheat, and sixty-four bushels of barley to the acre; and that in the county of Kent, soils of middling quality, ameliorated, yield per acre, fifty-two bushels of wheat, and the same quantity of barley. But in Flanders, there are soils which yield much more than this—namely, seventy-two bushels of wheat, 120 of barley, 128 of beans, and seventy-two of cole-seed. These, however, are extreme cases, which do not affect the general question of comparative growths; while, however, they show that the amelioration of land, in any country, is calculated greatly to increase its productiveness.

† "It is within my knowledge, (says Vanderstraeten,) "that villages of 6,000 acres of surface expend, in the purchase of dung and other manures, more than £26,000 sterling, besides the enormous quantity of dung from their own cattle. This expense is immense, but it is returned with the greatest usury.

lined with the same cement to receive this valuable deposite. This liquid manure is commonly reserved to enrich the ground during the second and third year's cropping, an abundance of the more solid manure having been spread the first year of the course.

Nor is the Flemish farmer indifferent to the conversion of weeds, waste straw, and other vegetable matter into manure. These he collects, and disposes in such a manner as to produce fermentation, by which the whole mass is decomposed and converted into a fertilizing substance.

2. *Digging.*

Under this head, I shall content myself with the following quotations from "Vanderstraeten's Survey:"

"In Flanders, before the introduction of the operation of digging, few lands, or rather none, had a stratum of vegetable mould of eighteen inches deep. It is art and industry which have created this. The greater part of her beautiful fields were then only moving sands, or soils even still more ungrateful. Observe, then, the methods which were used to raise them to their great fertility. In the beginning, they were dug to a smaller depth, and upon the moving sands was spread a great quantity of dung, of which the grosser parts, as well as the straw which was mixed with them, were decomposed into fertile soil. It was the same with the grain and stubble left by the crops, with the noxious weeds and roots. All those vegetable remains began to give fertility and consistence to the sands, and in proportion to the fertility and consistence which the soil acquired, the spade was pushed to a greater depth. The sand, of which the spade increased the vegetable stratum, was already no longer barren, because it was enriched with the juices of the dung, which the rain had carried below the depth to which the spade had not yet reached. The abundance of dung and the annual supply of vegetable matter, changed, in the end, this moving sand into the blackest mould, which can possibly be seen, in some places of a depth of eighteen inches, and in others of two feet!

"The methods taken with the other soils, more ungrateful still, were nearly the same. The amelioration which the Flemish agriculture produces in soils almost steril, is annually visible; but, in all cases, the greatest possible degree of fertility can only be the work of time. This amelioration, however, may be produced very rapidly in soils which have, at their commencement, only four inches of vegetable mould, and which repose on a stratum of good earth, though rendered as hard as a rock by the plough-share. A similar low stratum existed in Flanders before the introduction of digging.

"Periodically, every three, four or seven years, the spade, in Flanders, raises upon the surface a stratum of earth, which, under the stratum that has produced the crops, has enjoyed a fallow of three, four, or seven years, and, in consequence, has yielded no crop itself; a stratum already fertilized, in some degree, by the decomposition of the weeds which grow upon it till the moment when it was buried, and enriched with the salts of the dung, caused by the rains to filtrate, during the interval, through the upper stratum. This stratum may, therefore, in consequence, be regarded as a virgin earth, possessing the most extreme degree of fertility, through the manure it has received, and to which more is now to be added.

"The operation of digging, especially in light soils, is performed with great rapidity. A good workman can dig in the space of a day, the twenty-fifth part of an acre, to the depth of eighteen inches, at one stroke of the spade. He thus buries the upper layer, and brings to the surface the lower layer, which has produced no crop for three or for seven years, nor the same crop for six or for fourteen."

I shall embrace the earliest opportunity of resuming this interesting subject.

Yours respectfully,

GEO. HOUSTON.

New York, May 1, 1820.

ADDRESS TO THE DORCHESTER (MD.) AGRICULTURAL SOCIETY,

By Joseph E. Muse, Pesident.

Delivered on November 2nd, 1837.

Requested by Resolution of the Society, to be published in the Farmers' Register.

Addressing an audience so highly respectable, intelligent, and informed—and too, upon a theme so full of dignity, utility and science, as the present, it is natural that I should feel embarrassed in the undertaking, and solicit their favorable indulgence; resting my claim upon the integrity of the purpose and the excellence of the cause, rather than upon the hope of a successful performance of the task.

The character of agriculture, the great object of our present devotions, has, from the earliest memorials of man, been highly estimated—because, it had been ordained by the author of all good, and was co-essential and coincident with human life and sustenance; from the remotest periods of civil history, it has occupied an elevated rank, correspondent with that of the human intellect; and at the present day, the impress of its divine authority, is to be found in the loftiest eminence of the natural sciences.

In this sublime group of omniscient creation, we behold the faithful confederates of agriculture, in unremitting attention upon this '*alma mater*' of the universe. At the shrine of this dignified majesty, we behold her numerous votarists, geology, mineralogy, zoology, chemistry, physiology, botany, meteorology, and a host of others, offering up their daily contributions.

Before an audience so enlightened as that by which I am now honored, to dwell upon the merits and excellence of an object of universal admiration, by all whom providence has blessed with capacity to admire, would be vain and superfluous. To demonstrate the importance of agriculture, it has been justly said, would be "like demonstrating the advantage of having food to eat, and clothes to wear," and the classic Ovid, before the period of the christian era, has registered in strong and comprehensive terms, the devotion of the Roman citizens to this tutelar divinity, '*prima dedit fruges—prima dedit leges—Cereris sunt omnia munus.*'

I shall therefore call your attention to such topics as may appear to come within the immediate scope of the purposes of our society, and to form the great motives of our institution—the pro-

motion of this dignified character--a few of the reasons why she slumbers—and some of the measures which may contribute to her revival.

These are the grave and weighty subjects of consideration, which hang upon the minds of all her advocates—of all who are worthy of estimation in the community. Who is not her friend, is her foe; and her foe is the foe of mankind. Will this sentiment be controverted by the plea, "I am a lawyer—a physician—a divine?" Are these not concerned, deeply concerned, in the promotion of agriculture? Shall these honorable members of society say. "We have no crops—no stocks—no articles for exhibition, or premium, and our moneys shall not be wasted in this idle pageant?" I hope the day may not arrive, when experience too late may teach the error of this evasion—when too late, they may revoke their judgment, and expiate their delinquency, by the adverse destinies of their country, themselves, and their posterity.

In taking a view of the agricultural interests of Dorchester—indeed of the Eastern Shore of Maryland, and perhaps of the state at large—the first alarming fact, presented to the mind anxious for the welfare of its native home, is the rapid emigration of its citizens, to other growing and rival sections—and the menacing prospects of depopulation and impoverishment.

The question naturally occurs, whence comes this fatal course of events? Why should Maryland, whose geographical position and geological resources are equal to any in the union, loiter in the rear of other sections of our promising territory, and when they are swimming in the flowing tide of successful experiment, is she sinking in the stagnant pool of adversity? With every natural advantage, which providence could reasonably bestow upon her, she is on the brink of perdition—yes, merited perdition—spontaneous and suicidal. Whence comes then, this imminently impending fate, at once so wanton and so unnatural?

This is a grave question, full of consequences, and one which it becomes our duty to our country, to ourselves, and to our children, to investigate, and remedy, by all the moral force we can command; by all the intelligence and information we can acquire—by all the physical abilities we can bring into action. Without the concurrent influence of these powers, our native and beloved state will be abandoned, forlorn and desolate—our children impoverished, and our memories handed down to posterity as just and fit subjects of desecration and contempt.

Whence comes then, I repeat these physical and moral evils?

With due respect to the honorable body of our legislature, I maintain that their apathy and their injustice have contributed largely to these misfortunes.

I am conscious of the obnoxiousness of this sentiment—but I wish to be understood as applying my remarks to the principle—'*ad rem*' and not '*ad personam*,'—not to the agent, but to the action. That honorable body have refused a fostering hand, when supplicated for assistance, and under circumstances of the most imminent peril, when redemption and preservation were within their command. When other interests were regarded and sustained—rail roads and canals indefinitely countenanced—rocks and mountains excavated—embankments erected upon valleys, at the cost of millions--all these bounteous acts of beneficence have been conferred upon other interests, when the needy and suppliant farmer has been rejected, and refused a dollar from the munificent chamber and its overflowing coffers; with a sad and ominous veto upon his last hope—yes, upon his rightful claim and demand—he is told to retire. "We have other bantlings to nourish, more deserving of our favor, more congenial to our fancy; you are a passive subordinate creation, others there are more bold, more prominent—when they are satisfied, you shall have the fragments, if any there be, remaining of the feast."

When this key-stone of the ark of safety, wealth and independence, is already loosened, and the great fabric is tottering before the eyes of that honorable body, when in this perilous condition, this devoted class, the tillers of the soil, are driven from their native attachments, by successive and continuous losses and misfortunes in their professional occupations, to a land of strangers, to the west and south, where the youthful vigor of nature has not yet been impaired, or to the north and east, where, under the auspices of a more liberal and propitious policy, the menacing approach of decay is arrested, and the consequent impending evils averted by legislative wisdom, by bounties, and premiums for the growth and manufacture of new species of crops, which an altered climate and other circumstances had demanded, in place of the old and accustomed routine; when these things were known to the most uninformed, this depressed class is rejected, unassisted, unheeded, and unregarded.

While I have the faculty of speech, to utter the sentiments of my heart, and to express the convictions of my mind, I will denounce, because I abhor, this action of our legislature, as a violation of the principles of political justice, and true political economy, and leading to the ruin of the best interests of our country. It inclines me to exclaim with the astonished poet, '*proh superi; quantum mortalia pectora, cæcæ noctis habent.*'

In concurrence with other causes of a physical character, this policy, this false judgment, of that honorable body, has nearly extirpated the last hope of agriculture in Maryland. And without a speedy relief, this radical interest, from which all others spring, and upon which they subsist, with its numerous retinue of dependants, will lan guish, and irrevocably be lost.

In regard to the physical causes of the menacing condition of our agricultural interests, the most general and prominent may be found in the fluctuations of climate and the present unfitness of 'station' for the wheat crop—a term used by geologists, to denote that locality of animal and vegetable existence, where a combination of physical circumstances, favorable to the development of their repective organization, may have established them.

Many centuries ago, the classic farmer of Mantua, the immortal Virgil, impressively taught the importance of this inquiry, the fitness of station, and to learn the winds and the various qualities of the climate, for successful cultivation: '*hic segetes, illic veniunt felice uvæ*,' and he adds, these laws and eternal regulations, nature, from the begining, ordained.

Without occupying your time to dwell upon the beauties of this arrangement, upon this conspicu-

ous instance of providential wisdom, goodness and power, which all nature is daily unfolding to our view, it is sufficient, for the present purpose, to notice the fact of the geographical distribution of the whole organic world; by this rule of specific self-adaptation, implied in the term, station—it is one which is accepted as a truth, by the common consent of mankind, because it is founded in the natural and necessary sequence of cause and effect; it is one which offers a rational solution to the difficult problem, that '*questio vexata*,' the loss of our wheat crop—and it is full of interest to all, more immediately, perhaps, to the agricultural class of our community. On this important fact, geologists too have instructed us—differing only on some relative questions of theory and individual opinion.

At that eventful olden time when the first creative hands, converting chaos into form, consummated the great work by organic life, innumerable evidences are furnished, in the fossil remains, that the animal and vegetable structure was simple and imperfect, in conformity with the rude condition of the earth, climate and other physical circumstances under which they were placed. As this condition altered and improved, so did their structures become more perfect and more complex, until by an uninterrupted succession of physical events, we behold nature as she is, enchanting to admiration, and in her sublime works of mechanism and design, bespeaking her divine authority; and by her infinite wisdom and power, confounding the infidel, and establishing the conviction of his folly and his imbecility.

Whether this progressive improvement of animal and vegetable life was effected by a successive creation and destruction of new species, or by a transmutation of the originals, and their progressive advancement to a more perfect state, are questions not essential to our purpose; as the important truth remains in either case unaffected, that fit stations are essential to the life and prosperity of the respective species, and they must find them, or perish, by the established laws of nature.

That many animal and vegetable species have become extinct, since their first creation, cannot be reasonably questioned; numerous fossil evidences establish the fact; yet in the general, the doctrine of progressive improvement and transmutation, is consistent with experience and daily observation; and in the instance of our wheat plant, we have many of us witnessed, and I have long since maintained upon good authority, its partial "transmutation" against the bold assertions and inveterate dogmas of adversary opinionists, who seem to hold their creed of physiology as a code of moral law; and from their sentimental asperities it would seem, under equal penalties for transgression.

Upon the fact of transmutation of the wheat plant, much evidence might be adduced; it is sufficient for the purpose to name that of a learned friend, Mr. Featherstonhaugh, the United States' geologist, whose acute observation, and high and well-merited fame, and acquirements in the natural sciences, are ample pledges of its accuracy, that he has seen stalks of cheat developed from a grain of wheat, under the most infallible circumstances; and I might name others which leave no doubt, on my mind, of the fact of transmutation occasioned by the influence of various physical accidents.

The famed Lamarck quotes many examples of the changes of plants in their forms, faculties, and even in their organization, by a change of the physical conditions under which they are placed; and he justly observes, what nature brings about in a great lapse of time, we may occasion suddenly. Some plants are made to lose their thorns; some, the acridness of their juices; others have their ligneous, converted into herbaceous stems, and some, which are perennials, become annuals; an unfavorable climate, exposure to winds, and other accidental causes, may give rise to a stunted and altered race; and "*mutatis mutandis.*"

The extravagance to which Lamarck has carried out this doctrine, should not vitiate his truths. That man should have sprung from a monad of animated matter, and by progressive improvement have arrived at his present state of superiority, is absurd; yet it is unphilosophic to reject, absolutely, physical, moral, or religious truths, because they may have been mingled with fanaticism, or extended to absurdities. Gold is not contaminated by the base matrix in which it may be found, nor should the lights of truth, which this talented author may have thrown upon this interesting question, be extinguished by his casual follies; his lucid intervals make ample amends for his odious hallucinations.

We will leave this controversy, and revert to the important and settled truth, that plants as well as animals require certain physical conditions for their well-being, an essential point of which is climate, which for causes not fully known, has been, and continues to be, suffering variations throughout the globe, and tending to a diminution of temperature; and consequently no locality continues to be suitable for the same vegetable or animal at all times; and if our crops are not changed with the change of climate, by the force of intelligence and judgment, they will perish and disappoint us; they will change themselves by the force of the laws of nature.

In the present regions of Siberia, and many other northern countries, are found direct proofs of this fact, in the fossil remains of living species, the elephant, the lion, the tiger, the tree fern, the palm, and many others, as we are informed by Mr. Lyell and other distinguished naturalists, inhabitants now, only of more temperate climates.

To this cause, then, this gradual but continued lowering of the temperature of the globe, may be referred the failure of our wheat crops; and hence may be seen the necessity to supply the loss by others, adapted to the new physical condition of the country.

Twenty years and more have borne witness to the fact, that this great staple with us, is annually declining; the progress of this evil, though gradual, has been with few exceptions constant, and within the last few years, alarmingly conspicuous. The progressive revolution of the climate has been equally manifest, to all who are in the habit of observation, clearly indicating the cause and the effect; this essential incident of station, once so congenial to the development of our favorite plant, has assumed a new character adversary to its physiological constitution.

With the decline of the general temperature of the globe for ages past, and established upon accumulated and unquestionable evidences, collected by distinguished naturalists already named, an-

other important and relevant fact is equally attested. that under the influence of this change, plants and animals, with the exception of a few individuals, have been from the most ancient periods of time, regularly and gradually migrating from higher to lower latitudes; the latter, from the general decline of heat, having acquired that degree for which they had been constituted; and which the former had previously possessed and now lost; hence, we have no reason to flatter ourselves with the hope that our wheat plant will continue, and resist the instinctive impulse given it for its own preservation, by the commanding hand of nature.

And *a priori*—it is deducible from causes, obviously still in operation, that a comparatively short period, perhaps half a century or a little more, will find the wheat plant flourishing only in the most southern sections of our vast empire; and another period still longer, may in all probability, cancel it from the catalogue of vegetable life.

Our sister states of higher latitudes, have long since experienced the effects of this mutation of climate upon their wheat crop; the 'Northern Farmer', of New England, informs us that fifty years ago, their wheat was a certain and profitable crop; and that now, they cannot by any mode of practice produce enough of this grain to defray the costs of cultivation.

Thus, by a diligent review of the past, we are enabled to direct our course for the future; we are furnished with a key to unlock the magnificent temple of nature, disclose her enchanting secrets, and contemplate her wise and providential plans, for the general good of her creation.

A fallacious ground has been assumed, and on very respectable authority, against the continuance of our wheat crop, which though leading to the purpose of my proposition to abandon this plant, is wholly untenable—that land tires of a species. This, in the sense designed, is an unphilosophic notion, and may produce much error in practice.

The theory of rotation of crops rests not upon this principle, but upon the appetency of plants for ultimate principles, peculiarly essential for their sustenance, and respectively consumed in the different ratios of their natural demands; by a fresh supply of manures, the consumed principle will necessarily be furnished, and the capacity of the land for reproduction, be restored, or perpetually preserved. But it is said by the advocates for the land-tiring doctrine that the remedy of manuring is incompetent for a wheat crop, where formerly the plant flourished; true, because the station has become materially modified, and for reasons already given, we must adopt others whose habits and constitutions are conformable to this modification.

Our desire to retain this crop, is founded on an amiable principle in man, often conducive to his interests; that of a venerable attachment to the prescriptive law of usage, yet it is a law, which like all others, has its numerous exceptions, to be found in the absence of the reasons from which they derived their validity. In regard to this interesting question of the policy of continuing our wheat crop, another consideration may be offered, entitled to much weight.

Every individual plant, as well as animal, has its respective tribes of parasitic insects, which peculiarly belong to it, and which follow it, in its progressive migrations, before mentioned, at a less or greater period after its removal to its newly adopted station. The longer the time it shall have occupied its new domicil, the greater will be the hostile array of these predatory tribes upon it. No better evidence can be required of this truth, than the instance of the Hessian fly, which for many years, had not annoyed our wheat crop—yet, has accumulated, until, alone, it is now competent to its destruction: and annually, we hear of new enemies, multiplying upon this plant; and, which, too, will never abandon their post, while we supply them with the choice forage, for which, they had made their incursions.

From a change of climate, and other incidental circumstances, our rich harvests which, to ourselves, and our ancestors, had yielded a bounteous equivalent, for cost and labor, have degenerated into a fruitless heritage, continued solely, from ancestral veneration, and the irrefragable bond of usage.

For occupying so much of your time, upon subjects of natural science, which may have appeared abstract, and irrelevant to that of agriculture, I must make the apology of its necessity to demonstrate an important proposition, that our wheat crop should be, at least, considerably curtailed—and new crops, from other countries, substituted for it.

From the view I have taken, too, some useful rules may be drawn, for the direction of those whose enterprise may lead them to discover, and introduce such new crops, as may, with the greatest prospect of success, supply our necessities.

The most obvious rule, that grows out of the premises, for this purpose is, that the selection of plants be made from higher latitudes, than those to which they may be transferred.

Since we have seen, that the mean temperature of the globe is diminishing; and, with this cause, necessarily, a general migration of the vegetable and animal species, regularly, though slowly progressive, from the poles towards the equator, in quest of new stations, which may have become more suitable to their habits and constitutions—it follows, that our selections must come from higher latitudes, in conformity with the physical laws, under which they had been heretofore moving; and, with as wide a difference of climate as experiment may prove them capable of bearing: this removal will be only in anticipation of their natural impulse; and what this impulse would, in a longer time, have accomplished; and this principle of selection will afford a reasonable hope, *cæteris paribus*, of a longer enjoyment of the plant, than had it been found in the south, and brought back to a station, which, possibly, it may have deserted for its unfitness.

It has been wisely said, we may command nature, only by obedience to her laws: under her well-defined laws, as we have seen, the physical geography of the whole globe has been suffering a series of changes, from the earliest history of time—and, by a rule, based on this fact of natural science, the cultivator of the soil must select his crops, and graduate his system of cultivation.

Under this rule, the only hope remaining for a continuance of our favorite staple crop, will be found in seed wheat from higher latitudes. A spring wheat from Switzerland, and another from Florence, have recently attracted public attention; yet, but little is known of them; the common spring wheat has heretofore disappointed us; how far

these new varieties may supply the desideratum, is a question of intense interest, and merits the most prompt, and earnest investigation: I have purchased some small parcels for experiment, and shall be enabled, at the next autumnal exhibition, for the Eastern Shore of Maryland, to be held at Easton, to report the result.

The hope of a change of climate, propitious to our winter wheat, is delusive and groundless.

The extent of our continent, and its connection with the polar circle by a vast chain of high lands, have fixed upon us a climate of excessive rigor and mutability; when the continent of Europe, separated from these arctic regions by an ocean, enjoys, in the same parallels of latitude, a climate more temperate and more equable; and it is much to be apprehended from well known physical causes, that the excessive character of our climate will increase, rather than diminish.

The felling of our forests and the cultivation of our lands, as Mr. Lyell, and others have inferred, and the well known principles of philosophy teach us, will allow a copious absorption of heat, under our nearly vertical sun; which, radiated into the atmosphere, will rarify it, and bring in upon us an influx of the condensed, freezing currents of the northern mountains; and, the transitions from heat, to cold, will probably become more frequent, more sudden, and more considerable, in the direct ratio of those causes, which are progressive.

The same authorities too, teach us, and the general principles of meteorology support the doctrine, that forests have the effect of promoting rain: they cool and condense the atmosphere around them; which, mingling with the ærial currents flying over them, arrests their progress, and supplies us with genial showers, that otherwise might have passed in vapor.

From these considerations, it would seem too clear to be questioned, that our climate will not improve; but, on the contrary, will become more excessive, and the mean temperature, lowered—our winters more rigorous—our summers more subject to intense heat, and frequent drought, and wind; and the fluctuations greater than formerly, or at present.

Hence, the necessity to summon fortitude—and, by future wisdom, economy, and perseverance, to expiate our past follies—adopting the golden motto, '*ne cede malis, sed contra, audentior ito.*'

Under a conviction of this truth, and from repeated abortive attempts with the old routine, I have made the experiment of many new crops—and I regret to acknowledge I have not yet accomplished my views; yet, I have the consolation, that by the detection of many errors, I have advanced so many steps to my final purpose.

A cotton crop which I continued three years, produced, on the second, a strong hope of success, yielding twenty-five thousand pounds of seed cotton, from thirty acres; the third crop, on seventy acres, was almost a total failure; the texture was fine, and it commanded a better price than the upland southern; yet I found it too precarious for profit.

An experiment, a few years past, with hemp, was flattering. I have no doubt, that in our low black lands, the hemp crop would be a valuable acquisition.

I have, this season, grown the sugar beet—the white Silesian, and have a large product of fine roots which I contemplate manufacturing, when I receive my mill, which is contracted for—having prepared all the other necessary implements. A faithful report will be made of the result.

Upon a fair trial of the shipping bean, which had been highly commended, I experienced almost a total failure—under the most favorable circumstances, it did not pay costs.

An experiment with the palma christi, convinced me, though the growth was fine, that the tediousness of the gathering was nearly equivalent to the product of the crop; and I have denounced it, as interrupting more time than it is worth.

My crops of Spanish tobacco, from seed directly from Cuba, which I have, for the last two years, extended, in the growth and manufacture, to a large amount, have far exceeded my most sanguine expectations, in respect to both quality and number—the impediment to this crop arises from the difficulty of obtaining the seed, annually, (which is essential,) from its native soil and clime; in which, I have been disappointed, eight years in the last ten, either by the failure of the orders for it, or by its not vegetating, when received.

I have a few thousand mulberry stocks, multicaulis and white Italian, yet too young for the worm, without injury to their growth. This article, with its manufacture, needs no comment—produce it, and, *pro tanto*, you produce wealth—yet, with arms folded, we invoke the aid of Hercules; unconscious of our own resources—of our own abilities, to extricate the wheel.

Some saccharine and farinaceous roots—potatoes—beets—parsnips—carrots—though not profitable for field culture, might occupy a few acres to advantage, and would enable us to send to market more of our Indian corn, which, for several years, has been a scarce and costly article.

The turnip, the ruta baga, and all its varieties, though its introduction into England, is said to have made a memorable era in the agriculture of that country, I hold to be the most worthless of the cultivated roots. Its fibres are chiefly ligneous—its juices, aqueous. Without meaning any disrespect to its numerous eulogists, I might, fitly and technically, term it a simple *hydrate of wood*. It may answer the mechanical purpose of filling the stomach, and enabling it to grapple the nutritive matters received in it, and but little else. One of the best analysts in England, Sir Humphrey Davy, reports the common turnip to contain only forty-two parts of soluble, or nutritive matter, in one thousand—the ruta baga but little more.

In respect to the Indian corn, a crop of the first magnitude, it may seem superfluous to make a remark. Though well cultivated, on this shore, particularly, yet, it is a singular fact, that in the northern states, where the climate cannot be so favorable to its growth as that of Maryland, their crops are much more productive, yielding 80 to 100 bushels per acre, on lands of moderate capacity: when, on our best lands 30 to 40 is considered a good field average—and one-half of this quantity is more than an ordinary product. It follows, that we are defective, in some material point. It is possibly, in the sort that they excel us. I have this year, tried three of their varieties—but will say nothing decisively of them, until further experiment.

It is more probably, in the unnatural practice, of stripping the blades, and cutting the tops, be-

fore the grain is fully matured, hard, and firm. Under this general practical error, much is lost: and the present season, from my own observation, and the candid acknowledgement of many, a sacrifice of 20 per cent. at least of the corn of Dorchester, has been incurred, by this fashionable operation. This practice is considered essential to good economy—and to be performed, at a precise period of the sun and moon's places in their respective orbits; and all, who are, unfortunately in the rear, from accident, or design, are denounced as slothful farmers.

This force of prejudice, or, rather, this *'lex loci'* is one of the most insuperable impediments to agricultural improvement; and in no instance, perhaps, more pernicious, than in the practice in question—that of fodder-saving.

The vegetable leaves, or blades, are the lungs, or organs of respiration; and very analogous, in their functions, to those of the animal. They serve to oxygenate the juices of the plant, and prepare them for nutritive secretion, which is effected by clusters of glands at their base, or junction with the stock, thence to be transmitted through the system. Extirpate, or wound these organs, and their functions necessarily cease, or are impaired. While green and succulent, nature designs them to perform their respective offices—when withered, and dry, they are useless, as fodder. Hence the practice is indefensible, and it is one of the most unnatural, singular, and palpable errors, that ever obtained credit and currency in agriculture: and I verily believe, it is one of the principal causes of our short crops. Moreover, the blades above the ear, continue, longer, fresh and succulent, than those below it; hence, the clear inferrence—as the designs of nature, are never idle and superfluous—that their physiological purpose is longer required; and, the stalk having already attained its full growth, at the time the practice commences, the remaining purpose must, of necessity, be to elaborate the sap, for the nutriment of the grain alone.

If it be asked, what substitute for this fodder? the plain answer is to be found, in a few acres of the grasses, of which we are strangely deficient, at the present: with less trouble, and less cost, these would, abundantly, supply us.

I am aware of the hazard incurred by an encounter with popular prejudices—and by multiplied experiments with multiplied disappointments openly avowed—from a class of soi-disant prudentials, of whom it has been said, *'indocti stolidique, et depugnare parati'*—to these I willingly concede the palm.

In regard to live stock, though much improved by the previous efforts of our institution, yet much remains to be done. A few stocks carefully selected, well fed, and protected from the rigors of the winter, will be found most profitable. The latter conditions are generally held unessential to that valuable animal, the hog, which is supposed to possess the rights of ubiquity, and of subsisting by its own faculties of enterprise. It may be true, it is hardy and enterprising; and it is equally true, that the owner, who forces it to exercise these rights and these faculties, to the annoyance of others, is a moral as well as a legal agent of trespass—and to his own injury. Did he supply from his own resources, food and protection to this useful animal, he would be greatly profited, and his conscience would approve the act.

The subject of manures, and their peculiar fitness for different soils, would fill a volume. Upon this, I shall only remark, that *calcareous matter*, in all its combinations, with whatever acid, or derived from whatever source, is directly or indirectly an essential constituent of all manures—and without it, all are, at least comparatively unavailing. I cannot resist, on this subject, the impulse to pay a tribute of respect and acknowledgement to Mr. Edmund Ruffin, of Petersburg, Va. for his able 'Essay on Calcareous Manures', the fruit of much labor and research—and too, for his 'Farmers Register,' a monthly periodical devoted to the interests of agriculture, and sustained by the best talent and experience of the state.

Upon the subject of calcareous manures, I could add but little useful. I may simply illustrate one of its modes of operation, by the analogy, in a chemical view, to the action of alkalies on oils, with which they make a homogeneous mass, miscible with water; so does lime with putrescent manures, make with the soil, a tertiary compound, easy of solution, and well adapted for vegetable nutriment, when, without this intermediate substance, the mixture is merely mechanical, loose, and destructible by every shower or rivulet that may come in contact. Lime, too, is a constituent of the vegetable pabulum, though in proportions differing with the peculiarity of the plant, and like all other manures, it must be in a state of solution, to be admitted through the very delicate absorbents into the vegetable system—by its agency, the soil, the manure, and itself are placed in this condition.

I have witnessed with astonishment a very prevalent error, in favor of half burning shells for manure. It is too palpable to dwell upon the fact, that the more complete the calcination and consequent comminution of the particles, the greater space they will occupy, and the more efficient will be every particle in the space occupied; because more of its surface is exposed to action. If partially calcined, the space covered will not only be smaller, but it will contain much inoperative matter, and the general remark that in time, it will come into operation, is not rational. We surely wish it, when applied, to operate in the shortest possible time, with the smallest possible quantity, and with the greatest possible effect.

I have used the half-decomposed shells of the old Indian deposites, twenty years ago, which appear not to have advanced in calcination, more than one per cent. at the present day—requiring rateably for the full attainment of my purpose, the fearful lapse of about two thousand years, and consequently a goodly share of the king-becoming grace of patience. I confess, gentlemen I would rather have an earlier result—some may prefer to wait, yet, *omnia non pariter rerum omnibus apta.*

In respect to the quantity of lime, fifty to one hundred and fifty bushels per acre, are, upon the best authorities, stated to be the *minimum* and *maximum*, that may be used to advantage—dependent, chiefly, I presume, on the quantity of putrescent matters with which it is to combine—somewhat analogous to the law of chemical equivalents.

I prefer lime to marl, in general, because it has more identity in its composition, and consequently more of a definite uniformity in its action. Marl is often found in a *gangue* of ferruginous salts and other substances, fatal to vegetable life, and it va-

ries in its contents of the calcareous matter from five or ten to sixty per cent. or more, and considerably often in the same bed.

Of manures in general, we have unlimited resources: besides those of the regular farm yard, we have the surface soil of the forest, the bottom mud of marshes, branches and ponds—these require to be passed through the farm yard, to receive a portion of the saline offal, or to be heaped in the fall previous to their application with lime or ashes to correct their acidity—the oxalic acid prevailing, it is generally believed, in the former, and the sulphuric in the three latter—and to allow time for their intimate incorporation and maturity; which method, be the *rationale* right or wrong, the experience of many years has assured me, is essential to a good result.

Surface manuring, which is apparently at variance with every known relative principle, has some able advocates in experience—the adversary principles appear to be well established; yet the inferences drawn from them, may possibly be fallacious; or, others yet to be discovered, may preponderate. It is a question of primary importance, to ascertain the facts in the case, which may enable us to adopt the true practice, and arrive at the true principles on which a correct theory may be settled.

This leads me finally, to remark upon the inveterate antipathies, of many, to the very name of theory, and of books, and agricultural science. Upon this subject I have before dwelt with much earnestness, in the full belief of the marvellous and pernicious prevalence of the sentiment.

I assume '*consensu omnium*,' that facts are essential to this, as well as to every art or science—a graphical history of facts, records and preserves them from being lost or forgotten, and necessarily accumulates and virtually multiplies what is essential to the art or sciences. Theory digests, arranges and makes inductions, from the facts collected and preserved, and though the conclusions may be as various as the minds that draw them, and therefore cannot all be correct; yet they contain the various views and best judgment of those who are in the habit of reflecting and reasoning upon such subjects—and they present for the consideration of others, a comparative view of the various relations and inductions, of which the facts are susceptible. And thus they enable a very untutored mind to form a correct judgment, upon subjects which it could not have attained, without the assistance of books and the elucidations of science.

Of these advantages chemistry and geology afford well marked instances.

By chemistry, we learn the ultimate principles of bodies, and their several combinations; and, by a detection of those, which, in point of fact are conducive to vegetable life, as well as those, which are inimical to it, we are enabled to correct the one and supply the other, as interest may incline us—and, often by the agency of foreign substances, cheap and easily obtained, to convert rancorous poisons into salutary nutriment. Sulphate of iron, for instance, is a deadly poison to the vegetable system; the metal itself is innocent; chemistry teaches, that the acid having a stronger affinity for lime, than for iron—by its addition, the poisonous compound is converted into sulphate of lime, or plaster of Paris, a valuable exciting manure, leaving its former base, the iron, in its unoffending metallic state: innumerable instances might be adduced to the same effect.

The science of geology, for many practical purposes is useful to the farmer; as chemistry teaches the ultimate, so does geology inform us of what may be termed the proximate principles of the earth: by geology we may learn the proportions of the four primary earths present in the soil; silica, lime, alumina, and magnesia—which, combined with animal and vegetable matters, constitute the soil: and by their various proportions, make the various qualities which we daily witness.

A mode of geological analysis has been proposed by Professor Eaton, which I have found very convenient and simple; pursuing the course of geological deposition in miniature; that is, soils may be deposited from water, in a common tumbler, after a suitable preparation, so that the proportions of these earths may be ascertained; for which, he has given an excellent formula.

The advantages to be gained from these and other branches of science, notwithstanding the popular prejudices, are too obvious to need further remark: rest assured, that self-conceit, and vanity, have much agency in the adversary sentiment; and, as in the physical man, so in the moral and intellectual, the more inveterate, the more incurable the affection.

If any feel disposed to the fatuity, he should arrest it in the germ; he should make the earliest efforts to resist the vicious habit of his mind; to such I would address myself in the emphatic language of St. John, "sin no more, lest a worse thing come unto thee."

From these views, it is obvious, that books, as well as ploughshares, are fit instruments of agriculture; and, that this ancient, useful, and honorable profession is based upon, and essentially connected with science, in the broadest import of the term, extending to all the intricate plans and operations of the supreme architect of nature, comprehended within the vast orbs of the heavens, and of the earth; they are all directly, or indirectly, subservient to the great purposes of agriculture.

We have, then, it will be conceded, a learned profession, as well as a useful art, of which, its votarists may boast. Yet, as if to rebuke ingratitude to the great author of all good, we have in prospect, some black and ominous clouds, it is not my duty, if it were my will and power to discuss their origin, or foretell their issue. It would seem that not only the laws of the material world are working a deleterious revolution in our climate—but, that nature herself, had suffered a concussion, had lost her centre of gravity, and is tottering on the eve of perdition; and, that the whole machinery of the universe, with the ingenious developements of the human faculties, the fruits of time and experience, in moral and political discipline, for the social and individual happiness of man, are in imminent peril.

But it is consistent with true philosophy, to dismiss those grave and solemn forebodings—and to exert the best faculties of mind and body to avert approaching evils, and confide the issue to the great God of nature.

'Who knows, but he?—whose hand the lightning forms,
Who heaves Old Ocean, and who winge the storms.

Pours fierce the ambition in a Cæser's mind,
Or turns young Ammon loose, to scourge mankind.'

From the Cambridge (Md.) Chronicle.

CATTLE SHOW, &C. OF THE DORCHESTER (MD.) AGICULTURAL SOCIETY.

The cattle show, agreeable to previous notice, took place on the 2nd and 3d ult. The following is a list of persons who received premiums on that occasion.

Committee on crops award:

For the most profitable species of crop, and its manufacture, upon one acre:—Segars made of Spanish tobacco, grown by Joseph E. Muse, and manufactured on his farm; nett profit of $504 99 cents on one and a half acres, or $336 66 cents on one acre,
To Joseph E. Muse, $21 00

For the greatest quantity of wheat on five acres, 90 bushels.
To James Dixon, $10 00

For the greatest quantity of Indian corn on 5a. 1r. 24ps.—293 bushels,
To Thomas Haywood, $10 00

For the greatest quantity of Irish potatoes on 1a. 1r. 29p's.—254½ bushels.
To Martin Goldsborough, $6 00

For the largest quantity of sugar beet, 23½ barrals on 25 square perches—specimen wt. 17 lbs.
To Joseph E. Muse, $6 00

For the greatest number of mulberry stocks above three feet high.
To A. C. Thompson, $6 00

For the greatest number of cocoons,
To A. C. Thompson, $6 00

For the largest quantity timothy hay, upon 2a. 1r. 4p's.
To Edward P. Lecompte, $6 00

For the greatest quantity Spanish tobacco, upon six acres.
To Joseph E. Muse, $6 00

JOHN C. HENRY, *Chairman.*

Horses.

The committee on horses, award to E. N. Hambleton, the premium for the best stallion, $10 00

For the best brood mare,
To Tench Tilghman. $8 00

For the best colt,
To Salisbury Collins, $6 00

JOHN R. KEENE, *Chairman.*

Cattle.

The committee on neat cattle, not having seen on the ground, a bull over two years of age, which they deemed worthy of a premium, decided as follows:

That Martin Goldsborough, of Talbot county, was entitled to the premium of $6 for the best bull under two years of age.

That the same gentleman was also entitled to the premium of $6, for the best milch cow.

That Wm. T. Goldsborough, of Dorchester county, was entitled to the premium of $6, for the best heifer, under two years of age.

That Thomas Hayward, of Dorchester county, was entitled to the premium of $6, for the best pair of well broke oxen, under five years of age.

All, which is respectfully submitted.

JAMES B. STEELE.

Swine.

The committee on swine award to John Dorsey the premium for the best boar over one year old, $6 00

To Thomas Esgate, for the best brood sow, with a litter of nine pigs, $6 00

To Thomas Hayward, for the best sow pig, under ten months, $4 00

To Allen Vane, for the boar pig, under ten months old. $4 00

To Allen Vane, for the fattest and heaviest hog, $4 00

LEVIN MOWBRAY, *Chairman.*

Sheep.

The committee on sheep, award to Samuel Stevens, of Talbot county, the premium for the best ram $4- for the best ewe, $4, and also for the best lot of wethers, $4.

A. C. THOMPSON, *Chairman,*

Domestic Manufactures.

The committee on domestic manufactures, after a careful investigation of the articles submitted to their inspection, beg leave to report that they have awarded the premiums as follows, to wit—

For the best 12 yds. domestic flannel, to Mrs. James Dixon, $4 00

For the best 16 yds. of linsey, to Mrs. Robert Rawleigh, $4 00

For the best 28 yds. of carpeting to Mrs. Benjamin Woodard, $4 00

For the best hearth rug, to Mrs. Joseph Byus, $4 00

The committee also awarded to Mrs. J. Bayly, Mrs. Leah Goldsborough, and Mrs. Mary Slaughter, a premium each for hearth rugs.

Best counterpane, to Mrs. James Vickars, $4 00

Best sheeting linen, to Mrs. Thomas Barnett, $4 00

Best table linen, to Mrs. Benjamin Woodard, $4 00

Best pair of knit silk stocking, to Mrs. Susan Thompson, $3 00

Best pair of woolen stockings, to Miss Emily Dorsey, $2 00

Best pair of cotton stockings, to Miss Elizabeth Woodard, $2 00

The sewing silk exhibited by Mrs. Henrietta Tilghman, of Talbot county, and Mrs. Sarah Goldsborough, (Shoal Creek) were superior specimens of the article, and equal to any we have ever seen of the imported Italian silk, and we think it highly deserving a premium.

Dr. A. C. Thompson, exhibited one and a half bushels of cocoons, from 5,000 silk worms, also a report of 1,000 mulberry trees raised by him, who for his zeal in promoting the interest of the farmer and agriculturist is eminently deserving of a premium, and the thanks of the society.

The committee on agricultural implements, award a premium to Tench Tilghman, of Talbot, for a wheat cutting machine, invented by Mr. Hussey, $8 00

JAMES A. STEWART, *Chairman.*

The committee on butter, award to Mrs. Martin Goldsborough, for the best 5lbs. of fresh butter, $4 00.

To Mrs. James Vickars, for the best 10lbs. of potted butter, $4 00.

S. W. LECOMPTE, *Chairman.*

The committee on fermented liquors, award for the best barrel of cider, to Benjamin Woodard, $4 00.

JOSIAH BAILY, JR., *Chairman.*

The committee on ploughing, award to J. C. Henry, a premium for the best ploughing in the shortest time, $3 00

And to the ploughman, $4 00

The committee would also, had they the power, award a second premium to Tench Tilghman, of Talbot county.

E. P. PHELPS, *Chairman.*

KYANIZING TIMBER FOR RAIL-WAYS.

[The following remarks were appended to a republication of the article on this subject which first appeared in the 'Farmers' Register' at p. 243 vol. 5.]

An article on the application of "Kyan's process for preventing dry rot" to the timber used in the construction of rail roads, communicated by me to the "Farmer's Register," having been republished in the National Gazette of the 10th inst. a few additional observations seem to me to be required.

That article was written especially for the section of country in which it was first published, where all the rail roads which have yet been made are graded only for single tracks, and the superstructures are composed of timber, capped with plates of iron. In this section, where more expensive works are sometimes constructed, and more durable materials employed, the subject does not at first come so directly home, in all its bearings, as it will upon more particular investigation.

A permanent work, so far as practicable within the means of the state, corporation, or individual executing it, is of the first importance and the universal aim. With this view, for a long time timber was entirely thrown aside in the construction of rail roads designed to be of this class; and various plans, involving every possible combination of stone and iron, were devised and put in operation.

But the wear and tear of cars and engines upon rail roads composed of such rigid materials, and the difficulty and expense of keeping those roads in repair, have been found to be so enormous, that stone is now almost entirely abandoned in the plans of new works, and timber makes a component part even of those which are intended to be the most perfect. So that at the present time, very commonly in England, and almost universally in our country, wooden sills and iron rails form the first class of rail roads, and entire wooden superstructures, with iron plate rails, form the second class.

Economy has led to the adoption of the latter kind of rail road very generally in this country; and *experience* has proved that in a mechanical point of view, it is far preferable to the former. The superior connexion of its parts into one complete whole, of which the material admits, and the comparatively small liability of its becoming deranged by climate, settlement of the banks, or any other evil to which works of this kind are exposed —decay excepted—places it first of all in the scale of usefulness. Then, to preserve from decay the timber which enters so largely into the economy of these works, and thus rendering this *simple*, and, to us, most *convenient* plan of road, one of the most *permanent*, as well as the most *useful* and *economical*, is of the utmost consequence.

That this can be done, is placed beyond doubt by the experiments which have been made in England for the last ten years upon 'Kyan's process,' and the full confidence reposed in it by men of science in that country who have witnessed its operation.

How long the prepared timber will last in comparison with the unprepared, has not been ascertained. All that can be said on this score is, that no prepared timber has yet been known to decay, although it has been subjected for years to a deleterious atmosphere, where unprepared timber always decays in a few months. For all the purposes of rail roads, therefore, we shall not err in classing it with the most *durable materials.*

In the article published in the 'Gazette' it is shown that the expense of preparing the timber for a rail road on the plan of the Petersburg and Roanoke road, (and the same estimate may be applied to *single track* wooden roads in general) will be $762 50 per mile; which, by various expedients therein mentioned, it is assumed, may frequently be reduced to $250 per mile. But suppose no reduction is possible; still great benefits are to be gained at a very small expense.

By the application of this process to its full extent, the savings in *first cost*, in rail roads of the first class, or what are usually denominated permanent roads, may be put at 3000 dollars *per track* per mile, or 600 dollars per mile for a double track road; and the *annual saving in repairs*, taking the Columbia and the Portage rail roads as standards, must be at least 200 dollars *per track* per mile. At the same time, as has been said before, that we have a better road.

These roads however, have *stone blocks* for the rails to rest upon, with only an occasional sill of timber, and, therefore, do not afford a fair criterion on which to estimate the repairs of a road of this class constructed at the present time, which would have all its sills of timber. But the repairs of a road even of this kind supposing also the sills to be of prepared timber, would exceed, by a considerable amount, the repairs of a road composed entirely of that material, for reasons which I have before given.

Viewed in any light, the subject is of the greatest consequence to this country, and I trust it will be followed up by experiment and investigation as it deserves.

G. M. TOTTEN.

Philadelphia, October 17th, 1837.

From the Genesee Farmer.

WATER POWER.

The discovery of a new application of water power, the results of which promise to be of an important character, has been made by a tradesman of Greenock, and is thus described in the Greenock Advertiser:

Like all truly valuable discoveries, it is distinguished alike for simplicity and efficiency. It consists of a cylinder and piston similar to those employed in a steam engine. To the cylinder there are two entrance and two discharge pipes, one of each on either side of the stuffing box of the piston. The same turn of the cock that admits the water into one part of the cylinder opens the discharge-pipe in the other, and thus a vacuum is formed. To work this, advantage is taken of the pressure of the Shaw's water, the height of the reservoir of which gives it a force of 60 lbs. to the inch in the lower parts of the town. A short time ago we witnessed an experiment with a cylinder two inches in diameter, worked with a jet of water somewhat less than a quarter of an inch in diameter, and the piston, although loaded with one and a half cwt. rose and fell sixteen times in the minute. In this case the entrance and discharge-pipes were equal in size, and the cylinder was placed in a vertical position. Since then, the discoverer has had another model made with the cylinder laid horizontally, and with the discharge pipes nearly three times as large as the entrance ones, and by this means the motion was increased to twenty-six double strokes in the minute. The cheapness of an aparatus of this kind and its efficiency wherever there is a sufficient height of water to work it, must be obvious to all, while its managebleness, and freedom from danger, are no less conspicuous. The merit of the discovery is due to Mr. W. Allison, a mason of this town, who first suggested this novel application of a well known power to Mr. Baird, engineer, and Mr. A. Fairgrieve, who have materially aided him in reducing it to practice.

One use to which Mr. Allison conceives it to be peculiarly applicable, is the hoisting of heavy goods into warehonses. The Shaw's Water Company, for 7*l.* a year, give a supply of water equal to 1000 gallons per day. This water, injected into a cylinder ten inches in diameter, he calculates will raise to the second floor 390 tons per day, to the third floor 200 tons, to the fourth 150, and to the fifth 100 tons. The cost of the water for each day's work is about 5*d.* The goods in question will be raised 39 feet per minute. These calculations have proceeded upon the pressure on the water introduced into the town for domestic purposes; but a pipe from the Compensation Dam at the paper mill from its superior height, would give a pressure of about 200 lbs. on the inch.

From the Richmond Whig.

DECREASE OF THE TRADE OF THE SOUTHERN, AND INCREASE OF THAT OF THE NORTHERN PORTS.

[The following extract is from one of the numbers of a series, now in the course of publication, by a writer who signs himself "Patrick Henry," It forms an appropriate appendage to the report given in our last No. on the 'Southern Convention.']

It is a melancholy truth which ought long since to have been impressed upon the mind of every southern politician, that while the north has been gradually advancing in prosperity and wealth, the south has been as gradually declining. Whatever may be the cause, the fact is undoubtedly so. Sure it is not from the want of resources. We have all the elements of commercial greatness. The staples of the south furnish by far the largest item in our domestic exports. Let us see the facts.

The value of exports from this to European countries, in the year 1832, amounted to $44,676,463. Of this amount, cotton, rice and tobacco, (articles of exclusive southern production,) were of the value of $38,506,257, leaving that of all other domestic articles exported, only $6,170,206. But, as it may not be considered fair to take, as data, the exports of a single year, we will adopt the average amount of domestic exports for a series of years, viz: from the year 1821 to 1830. That average, in round numbers, according to authentic statistics, may be put down at $53,000,000. The average amount of cotton, rice and tobacco exported during the same period, is estimated at $33,000,000, in round numbers.

Now the population of the staple growing states, (or that portion of the population of those states engaged in the production of the southern staples,) may be put down at $4,000,000. The balance of the states not growing these staples, may be estimated, on point of population, at $8,000,000. So that a district of the southern country, with a population of four millions, exports thirty-three millions of domestic produce; while the rest of states, with a population of eight millions, furnish for exportation only twenty millions, from which must be deducted the amount of domestic manufactures exported, say five millions, and the amount of domestic exports of all the states, save those which grow the southern staples of cotton, rice and tobacco, will be fourteen millions only. The result is, that the staple growing states, with one-third of the population, produce more than two-thirds of the domestic exports of the country.

It is not, therefore, that nature has not been bountiful to the south, that she has been doomed to commercial inferiority and dependance. Nor is it the want of enterprise. There is as much in southern character, education and temperament, to stimulate enterprise as in the northern. The only difference is, that while the spirit of enterprise, *common to the people of both sections of the union*, has been repressed in one case, it has been stimulated and encouraged in the other, by the unequal fiscal operations of the government.

But let us continue the picture of southern decline. While the south is the producer of the great articles of domestic export, she has dwindled in respect to import trade, to a point of insignificance which is absolutely disgraceful. Producing more than two-thirds of the articles which are given in exchange for foreign merchandise, she is the importer of not one-tenth of the merchandise thus received in exchange for her staples.

The southern reader, unaccustomed to statistical examinations, will be astonished, when he

comes to behold in figures, the almost incredible depreciation of southern trade. With the hope that it may excite serious reflection, and open the eyes of the southern people to their true condition of commercial vassalage, I will illustrate the subject by actual statistics.

Perhaps it is not known that; prior to the revolution, the import trade of Virginia and South Carolina each far exceeded that of New York, Pennsylvania, or any one of the northern colonies. Yet such is the fact.

From the 'Virginia Gazette' of July 2nd, 1747, I find the following: "A list of ships and vessels which sailed from Hampton roads, under convoy of his majesty's ship, Folkstone, Captain Gregory." Then follow the names of the several ships, their commanders, and ports of destination, concluding with the following sentence: "There are *besides these*, many others, which had not received sailing orders when this list was made out, the whole amounting to fifty-two sail." All of these ships were bound for foreign ports, principally London, Liverpool, Glasgow and Bristol. Scarcely, a number of the Gazette, too, that did not contain a list of foreign arrivals in the ports of Virginia, from the year 1747, to the breaking out of the American Revolution. Then Virginia, but a colony, enjoyed a large export and import trade. In one day, fifty-two sail left her waters, freighted with domestic produce, to bring back in return rich freights of English manufactures. When did we last see, or when shall we again see, a fleet of fifty sail gliding from our waters in pursuit of foreign ports? Never, until the fiscal action of this government shall have been changed. Then, be it recollected, there was no connection of government with banks; there were no banks at all; one colony was not cherished and built up, at the expense of another, by the unequal fiscal action of the government; each colony was upon a level; each could compete with the other; each relying upon its native means and resources; and hence the trade of Virginia at that period. But to continue the statistics.

In 1769, the value of the imports of the several colonies was as follows:

Of Virginia,	£851,140	sterling.
New England States,	561,000	do.
New York,	189,000	do.
Pennsylvania,	400,000	do.
South Carolina,	555,000	do.

The exports were in about the same proportion, Virginia exporting nearly four times as much as New York, and South Carolina nearly twice as much as New York and Pennsylvania together, and five times as much as all the New England states united.

The same relative proportion of imports is preserved until the adoption of the federal constitution, when we find them to be in the year 1791, as follows:

Of New York,	$3,222.000
Virginia,	2,486,000
South Carolina,	1,520,000

The above is the amount of imported merchandise which paid *ad valorem* and specific duties. But as there were few goods at that time admitted free of duty, the data given approximates to the truth. There are none to show the imports into the several states from the year 1791 to 1820, but the general fact may be assumed, that the import trade of New York and other northern states has been constantly progressing, while that of Virginia and South Carolina has as regularly diminished. From 1821, to the present time, we have sufficient data, and they exhibit the following, as the state of the import trade:

N. York.		*Virginia.*		*S. Carolina.*	
1821,	$23,000,000	1821,	$1,078,000	1821,	$3,000,000
1822,	35,000,000	1822,	864,000	1822,	2,000,000
1823,	29,000,000	1823,	681,000	1823,	2,000,000
1824,	36,000,000	1824,	639,090	1824,	2,400,000
1825,	49,000,000	1825,	553,000	1825,	2,150,000
1827,	39,000,000	1827,	431,000	1827,	1,800,000
1829,	43,000,000	1829,	375,000	1829,	1,240,000
1832,	57,000,000	1832,	550,000	1832,	1,213,000

Thus, the import trade of New York has gradually increased from £189,000 sterling, about £40,000, in the year 1769, and from about three millions of dollars in 1791, to the enormous sum, in 1832, of fifty-seven millions of dollars! While Virginia has fallen off, in her import trade, from two and a half millions of dollars, in 1791, to $375,000 in 1829 and $550,000 in 1832, not a great deal more than the freight of half a dozen ships!

From these calculations, a few curious facts appear. The imports of New York, were, in 1832, seventy times as great as they were in 1769. and nearly twenty times more than they were in 1791, when the first United States' bank went into operation. Virginia, on the other hand, imported, in 1829, about one-eleventh of what she did in 1769, and about one-seventh of what she did in 1791. In a period too, of eight years, the aggregate imports of New York amounted to 311 millions of dollars; those of South Carolina to about 16 millions, and those of Virginia to about five millions! New York imported, therefore, in 1832, eleven times as much as Virginia did in eight years preceding, and nearly four times as much in the single year of 1832, as South Carolina imported in a period of eight years. Again, New York imported in one year, (1832) nearly fifty times as much as South Carolina in the same year, and about 110 times as much as Virginia.

Thus, it seems, that while the south produces two-thirds and more of the whole domestic exports, which constitute the foundation of our foreign trade, her commercial dependance upon the north is most abject and complete. Her citizens pay a tax of at least twenty-five per cent. on the whole amount of their consumption. What the exact amount of this tribute is, it is difficult to determine. It has been generally estimated at ten millions of dollars, which is more likely to be below than above the truth. Upon the whole, we are brought to this truth, that while New York, and other of our northern sisters, have progressively advanced to a degree of commercial prosperity almost incredible, Virginia and her neighboring sisters behold their import trade reduced almost to annihilation.

It becomes the southern people, if they would be relieved from this disgraceful thraldom, to enquire into the causes which have produced it. We have already shown that it is not to be ascribed to the want of means or resources. In my humble judgment, it is the effect of the centralism of moneyed power; the consolidation at the north of an immense banking capital, in the form of a United States' bank, aided by the fiscal action of

the government. These causes are amply sufficient to account for the phenomenon.

MISCELLANEOUS REMARKS ON PRACTICAL AGRICULTURE.

Taken from the loose memoranda of a Frederick Farmer.

A perfect knowledge of farming can only be acquired from practice. Volumes of essays may be published and read—the sciences of chemistry, geology and botany, which beautify and aid the pursuits of agriculture, may be attained to proficiency—but the only true light which reflects an interest as well as profit upon the profession, is shed by experience.

How universal is the error touching this pursuit, and how many fail in consequence of its prevalence! That it is the easiest thing in the world to become a good farmer is the common belief; every thing which is necessary to be known is soon acquired. Egregious and fatal mistake! The law requires the study of a moiety of our manhood (*lucubrationes viginti annorum*) to reach excellence in adjusting the conflicting claimes of *meum et tuum*. Medicine and theology demand the mental discipline of many years, with the aid of lectures, experiments, zeal, and devotion, to teach the respective duties in which to improve or cure the physical, or moral condition of mankind. With the march of mind, the old law, even that every man is *born* a legislator, is exploded, though we still find untutored asses braying in melodious discord. The thrifty mechanic who plies his sickly trade acknowledges the advantages of a seven years apprenticeship; but the delusion still lingers with a majority of the world, that every man of industrious habits and of a good share of common sense, is competent to manage a farm.

Industry and common sense are certainly indispensable elements of success; but what but experience, and habits acquired by attention through a series of years, can compass the infinite details of a pursuit, depending on variety of soil, diversity of product, and vicissitude of weather—what are management of laborers, together with the judicious distribution of labor. To adapt to useful purposes, the chemical analyses of different soils —the rotation of crops—the best application of manures suited to soil and season. The practical power, in fine, of making "two ears of corn, or two blades of grass to grow upon a spot of ground, where only one grew before." Nothing sir, nothing but experience will avail!

Well written essays—the judicious experiments of others—are certainly useful auxiliaries; but the farmer who depends solely on the experiments of others, and takes no counsel from his own observation, nor resorts to a trial of his own skill, leans upon a fragile reed.

He hears, for example, of the productiveness of the orchard grass—of its yielding two tons of hay per acre, after 20, 30 or even 40 bushels of seed have been gathered, which will command about two dollars per bushel—that it affords, frequently, a second crop—delights in shade, and in moist land &c. He luxuriates in golden dreams. He sows his seed in a thin, wet soil, *overshadowed* with trees. Half the grass perishes the first winter, and the second year, a few bleached, and uprooted tussocks indicate the failure of his experiment. In disgust he orders his overseer to sow no more. Is he a practical, persevering farmer? he tries again. He selects a soil moist, but tenacious; naturally fertile or enriched by a heavy coating of stable manure. He encreases the quantity of seed sown to two bushels, per acre, for he has discovered that in its infancy it is a remarkably tender and delicate plant, and that much will be lost under the most favorable circumstances. He forbears pasturing it the first year, until its roots and branches are ramified over the surface of the ground. Surely he will then be rewarded for his pains.

In regard to timothy grass. He may have to combat the prejudice of good cultivators, for this general opinion prevails, that low and alluvial grounds are alone suited to its culture. Is he a novice? influenced hy there opinions, he goes on in the old way. He neglects his uplands, or sows clover and wheat, wheat and clover, until in our valley vernacular, the land becomes *clover sick*. He ascribes the yellow hue and diminished quantity of the grass, with a corresponding diminution of the succeeding crops, to a deterioration of his land. Let experience again perform her office, and point out to him the remedy. Relieve the land of a surfeit of one kind of diet, and create an appetite for another. By alternating his grasses, he will find the increased quantity of vegetable growth, in the substitution of timothy, for clover, will sustain his upland, and renovate the product of the subsequent crops of wheat, oats or corn.

Let me, sir, in connection with the above, state a fact, within the range of my own experiments. I have about 1000 acres of cleared land, most of it well adapted to wheat, and all to grass—the latter is one of my staples, and I pay great attention to the different varieties. Upon a portion of my upland some years ago during a wet season, clover grew (the sapling clover,) six feet in height, a size which savors so much of the marvellous, that I procured, and have preserved the certificates of some neighbors who measured some of the stalks. For the last few years, however, I discovered, with all the appliances of manures and plaster, a gradual decline of that grass. In harvesting my wheat, I observed here and there a volunteer branch of timothy of vigorous growth, mixed with my wheat. It suggested to me an experiment. After ploughing my land in June and July, as is my custom, and stirring for wheat, which I ploughed in, and then harrowed, I sowed timothy seed at the rate of about one gallon to the acre. It came up well, but fearing the effect of the winter frosts; and in order that my land should be supplied with the pabulum of the clover roots, I sowed the usual quantity of clover seed in the spring upon the timothy. The timothy however vegetated finely, for it was rather in the way of the cradlers during harvest. The succeeding fall it afforded the finest pasturage, which I used sparingly. This year, from a stiff clayey limestone field of fifty acres thus treated, I secured 73 tons of excellent hay, after gathering 90 bushels of seed, and from an other field of 30 acres of the same description of soil, and more hilly, prepared in the same way, I mowed 45 tons. I must not omit to remark that I did not secure this hay until after harvest, about the first of August, and that the clover which was mixed with the timothy, had moulded, and fallen down, and consequently a small portion only of it secured. Had it not been for the intervention of

harvest, I have no doubt I might have secured an average of 2 tons to the acre—a product equal to my rich meadow alluvion. At all events I am satisfied with results, although the experiment when first projected, excited the incredulity of my friends, who are now satisfied, and could not but admire during the past summer, two of the most beautiful fields of upland grass I ever saw.

Now, every fact discovered by a farmer himself, assists him more than all the theories, or all the experiments ever made by a hundred others. They sink deep in his memory, and supply data for safe calculation. The force of example in agriculture, as in morals, has no wide limits. It is apt to be circumscribed by our casual vision.

Unfortunately, sir, the cases of failure, among agriculturists, are more numerous, than in most of the other avocations of life. In the mercantile community, it may be assumed, that one in four succeed; in the learned professions, especially that of law, one in six; perhaps one third of those engaged in mechanical employments; but probably in our fraternity, not more than one in ten succeed. I mean success of a clear decided kind—the portion of him who improves his farm, and adds to it—makes money, rears a family and educates his children liberally. And why is it so? The means of success are more attainable than in any of the other pursuits of life. One cause has already been adverted to. It is engaged in under the delusive hope that it is a life of perfect leisure, and needs no application.

The romantic spirit of hundreds, invest a handsome estate, with the pleasurable ease of another Mantua, where the possessor can recline in pastoral simplicity, under his wide spreading beech tree, his flocks gambolling about him, and the green clad hills of nature spread out before him, to his delighted vision. These are all pretty notions; but there is unhappily more poetry about them than truth. Farming is a prosaic concern. It is a life of toil. I doubt not that Virgil was more indebted for his wealth to his writings, and the munificence of his patrons, than to any practical skill at hedging and ditching: and I cannot imagine worse farmers than Thomson or Cowper would have made.

Let no young gentleman, then, retire to his patrimonial estate, indulging in the vain hope of finding there another Campania Felix, where nature, unaided by the plough and the harrow, will pour into his lap plenty and profusion. Impoverished fields, and perhaps protested notes in bank, will, in a few years, rouse him from his dreamy existence. We are no more exempt than others from the operation of that eternal decree, "that man was made to live by the sweat of his brow."

But, sir, I am tedious. I have not been in the habit of writing communications for a number of years. If the experience of more than fifteen years' farming, disturbed occasionally by the duties of public and professional life, give me possession of any facts worthy a place in your valuable paper, I will reduce my scrap book to a little method, and, in future numbers, offer it for what it is worth. At best, my thoughts will be crudely conveyed, and as my name would add no value to the opinions advanced, I take leave to subscribe myself,

A FREDERICK FARMER.

THE BLACK WEEVIL—AND ANONYMOUS CONTRIBUTORS.

To the Editor of the Farmers' Register.

November 21*st*, 1837.

In your June No. of the Register, I discover that there is a piece written on the means of destroying the black weevil, by an "Eastern Shoreman of Maryland," who is disposed to find fault of persons who write for the Register and sign their proper names—his reason for which, I do not consider very good; although he may be right, and I wrong. He says, in his communication, that he did not know that the ravages of the weevil extended as far south as Virginia, North and South Carolinia. I think he must be a man that stays at home close, reads but little, and tries to find out less. I suppose if Mr. Webb, of North Carolina, had not have written his piece on the weevil, that we never should have heard any thing from the gentleman on the subject; but after his piece comes out, we hear of many who know the same remedy he prescribed to be good, and others know other things equally as good, and preferable, to prevent, but would not let it be known. As I am personally acquainted with Mr. Webb, and know that he is no man who wishes to shine by writing for the Register—or any thing else, except for the good of his country, and mankind generally, when he thinks by doing so in a plain and legible manner, he can do it—I am disposed to believe that he wrote his remedy through a pure and disinterested motive, and not to blazon his name before every reader of the Register, as the "Eastern Shoreman" is disposed to believe, as "conqueror of the back weevil." Now, for my part, whenever I see a remedy for any thing prescribed without the proper signature, I do not place half the confidence in it I should do, if otherwise. Now, Mr. Webb, nor no other person, I presume, has any right to doubt the remedy prescribed by the "Eastern Shoreman of Maryland," but why, we ask the question, did he not come out sooner, and let his remedy be known? Simply, I suppose, because, as he says that he did not know these ravages extended to Virginia, North and South Carolina. Well! we ask still further, did he ever publish his remedy in Maryland, where he knew they did great injury? (I would state here that this piece is not written against the remedy prescribed by the "Eastern Shoreman" at all; but merely against his opinions relative to the signature to be annexed. The reason why this has not come out sooner, is because the 'Register' of June failed to come to hand until very recently.) Mr. Webb may not have written as correctly as some others, yet I am disposed to believe that the 'Register' is published to benefit the farmer, as well as the scientific man, and we all know that the most of farmers, are plain, and require plain things, to be understood correctly by them. I do not pretend to be a learned man, yet I think any man may read Mr. Webb's remedy for the weevil and understand it. If that is done his object is accomplished. As for "Dr. Syntax," or any other person, if they feel disposed, they can make just as much sport of my communication as they please, as I shall be like the "Eastern Shoreman of Maryland," concealed in the dark.

GRANVILLE.

From the Cultivator.

BLIGHT IN PEAR TREES.

Several competitors have already appeared for the five hundred dollars Philadelphia premium, for a preventive of the blight in the pear tree. Two of the communications have appeared in the Farmer's Cabinet;* one from N. H. Watkins, of Prince Edward, Va. and the other from T. Emory, of Poplar Grove, Md.

Mr. Watkins, ascribes the blight to plethory, or too great a flow of sap, caused by pruning and ploughing; and the preventive he suggests, the utility of which he considers he has fully verified, is neither to prune, nor plough among the trees, after they have become well established, in growth. He recommends that manure, if the land is poor, and the trees require it, be applied to the surface; and thinks ashes constitute a good dressing.

Mr. Emory is of opinion, "that the cause of *blight* and destruction in the pear and apple tree, is almost always what the French term *coup de soleil*, (stroke of the sun;") and to avoid the stroke of the sun, he recommends that the trees be planted in a moist, but not wet soil, so as to be sheltered on the south-west by "tall, dense forest trees, or a *house* or *hill*."

We notice these communications, not because we think that either assigns the true cause of the blight, or recommends an efficient remedy or preventive; but rather to point out their fallacy.

The blight is not confined to the apple and pear, but extends to many species of the natural order of Pomaceæ, as the quince, service, &c. and appears and disappears at intervals of some years; and hence we infer, that it is not caused by a stroke of the sun, nor abundant flow of sap. These causes are continually operating; and if they produce blight in one season, they would produce it any season, and these trees would long since have been extinct among us. Both of these theories are contradicted by the well known laws of vegetable physiology. But we are not left to conjecture upon this subject. It has been satisfactorily shown, that the blight is owing to an insect, which is described and figured in the 'Memoirs of the Massachusetts Agricultural Society.' The first appearance of the blight, that we have noticed on record, was in 1780. We hear nothing further of it until about 1802, when we witnessed its effects during that and four or five subsequent years. It appeared in our grounds again in 1824 to 1828—since which it has scarcely been noticed, though it may have appeared in other sections of the country. During its last visitation, we lost, perhaps, a hundred pear trees, some apple trees, and most of our quince bushes. Of the pears, some grew in dry, and some in moist ground; some in ploughed, some in grass ground, and some in lanes where the ground was trod hard. The blight affected all alike. The only remedy that we thought beneficial, was promptly to cut off and burn all the diseased branches, taking care to cut below the discolored bark and cambium.

From the Mark Lane [Eng.] Express.

BEET ROOT SUGAR.

When the prospectus for the formation of a "Beet Root Sugar Company" was first issued, we cautioned our agricultural readers from embarking in the speculation, notwithstanding the flattering prospects which were held out. We did so upon two grounds:—first, from a conviction, that should the manufacture be entered upon, a duty would be imposed, so as to place beet-root sugar upon the same footing with colonial sugar; and, secondly, because the cultivation of beet-root for the purpose of making sugar would derange the system of husbandry, and tend to impoverish the land. Beet can only be grown by a liberal application of manure; that very manure which should be employed in the production of roots, as turnips or mangel wurzel, to be consumed by stock; thereby creating a new stock of manure. It may perhaps be said, that a crop of beet for making sugar is more valuable than the ordinary produce. The produce of an acre of beet, sold off the land, may produce a larger amount of money than a crop of grain or a crop of turnips consumed by cattle or sheep; but in land of ordinary quality, the extra amount obtained must be expended in manure, or the soil will become gradually deteriorated. The cultivation of land upon the four course system, where the nature of the soil and the means of the tenant will admit, is, almost by common consent, considered the best. The great merit of the system consists in an extended growth of green crops, thereby enabling the farmer to keep a large stock of cattle and sheep, which will produce manure upon the spot, and maintain the fertility of the soil. It may be fairly stated, that, under judicious management, the larger the quantity of cattle and sheep kept upon a tillage farm, the greater will be the produce of grain. The sale of beet-root off the farm lessens the supply of food for cattle, and thereby strikes at the root of good farming. In making these observations, we would have it borne in mind, that we do not deny but that in some isolated instances beet-root may be cultivated for this purpose with success. But we with confidence assert that the introduction of such a system generally, would be in the end injurious, both to the landlord and the tenant. It will be seen from our parliamentary report that a bill has been read a second time in the House of Commons, for imposing a duty of 24s. per cwt. upon sugar manufactured from beet-root in this country.

From the Farmer's Magazine.

TO GUARD AGAINST HORSE FLIES.

In order to prevent horses being teased with flies, take two or three small handfuls of walnut leaves, upon which pour two or three quarts of soft cold water, let it infuse one night, and pour the whole, next morning, into a kettle, and let it boil for a quarter of an hour; when cold, it will be ready for use. Nothing more is required than to moisten a sponge with the liquid, and before the horse goes out of the stable, let those parts which are most irritable be smeared over with the liquor, viz. between and upon the ears, the neck, the flank, &c. Not only the lady or gentleman who rides out for pleasure, will derive benefit from the walnut leaves thus prepared, but the coachman, the wagoner, and all others who use horses during the hot months.

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* First in the Farmers' Register—Ed.

For the Farmers' Register.

ON MANURES, SOILS, &c.

(Subject continued from page 9, volume v.)

Nelson county.

A gall is one of the most striking of the diseased spots, spoken of in my last communication, which is unable to cover itself with vegetation, through its own unassisted efforts. The earth seems to have lost its cohesion. The surface consists of a fine, powdery matter, which is blown off by the winds, and readily washed away by rains, until a gully often is formed. When that is the case, the disease increases, the gully becomes wider and deeper, other gullies form near it, where the gall is extensive, and often whole acres are ruined, for all purposes useful to man. And yet the subsoil, before the gall or gully reached it, possessed the principles of fertility, and if thrown to the surface by excavation, and exposed for a year or two to the atmosphere, would have covered itself with a rich coat of vegetation. The writer, some years since, had occasion to cut a road from the base to the top of a hill, worn out, (in the language of the country,) and having extensive galls on its surface, of some years' duration. The road ascended at an angle of from five to six degrees with the plane of the horizon, and the excavation, on the upper side, was, consequently, several feet deep. In two or three years' afterward, the earth, thrown from the upper side of the road, was covered with luxuriant greensward, *(poa viridis,)* and presented the appearance of a rich fringe, along the lower side of the road, whilst not a particle of that grass was seen any where else on the face of the hill.

The earth, taken from cellars, in the red clay region, although raised six or eight feet below the surface, is known to be highly fertile, after a few years' exposure to atmospheric influence. But the bottoms and sides of gullies at all depths, and after every exposure to the atmosphere, produce nothing in a similar soil, without the aid of stimulating manures. The generally received opinion is, that vegetable matter is produced, exclusively, by seed deposited in or on the earth. But there seems great difficulty in regarding this as the only source of vegetation, when the facts come to be examined.

If a spot of land is cleared in the forest, far removed from any other that is open, it puts up weeds and grasses of entirely a new character to their location, which could not have sprung from seeds recently derived from a distant cultivated country, and which, if derived from seed previously deposited in the soil, must have remained in a dormant state for many hundreds, perhaps thousands of years, before the moment of springing into life. Now, we know of all the seed we are acquainted with, that unless buried very deep in the earth, and beneath the influence of vegetation, it either rots or comes up, within a short space of time, in a genial climate. In the case, however, of land cleared in the wilderness, (if we imagine the weeds and grasses to be derived from seed), we must also suppose this apparently universal law of nature reversed, and that the seed remains near the surface for ages, in a dormant state, until the favorable moment occurs for vegetating.

In this part of the country, the locust, *(robinia pseudo acacia,)* is rare as a forest tree; but when the land is cleared, it at once springs up in great numbers, and grows with such extreme rapidity, in the intervals between the hoed crops, as to require considerable labor to keep the land in a state of proper subjection to the plough. But as the land begins to be reduced by cultivation in a considerable degree, when the surface soil is much washed, and galls and gullies become abundant, the disposition to put up the locust is changed; another species of growth, a dwarf pine, makes its appearance, although nothing of the pine kind had grown on or near the land before; and if permitted to remain undisturbed, will cover the ground with dense thickets.

This seems to be a provision of nature, to remedy the evils which may be inflicted by any of the circumstances that destroy the surface soil. The pine first appears on some spot where a little fertility is left. It sheds its long and round leaves profusely, which are not blown away by the winds, as the leaves of other trees, but adhere to the spot where they fall, and catch other things that move over their surface. Their decay produces some amelioration, and soon more pines appear. The process advances with proportionate rapidity, and the injured land becomes covered with a pine thicket. The leaves are lodged abundantly in the gullies. Their further deepening is arrested; they begin to fill, and, after some years, the land is rendered fit again for cultivation. The capacity to throw up pines, is withdrawn, as the land is enriched; poplars, dog-wood and other growth, indicative of fertile soil, then grow where pines alone were seen before. On the farm of the writer, there is a triangular spot, covering about an acre and an half of ground, and extending from the base towards the summit of a hill, of gentle declivity. This spot, twenty years since, was covered with galls and small gullies partly filled, and had a thick growth on it, of small pines. The ground, on the hill above it, bore a lofty and dense growth of oaks and other trees, and was excellent soil, as was also the land generally around. The spot in question, had probably been the site of a hunter's or squatter's cabin, in the early settlement of the country; but no certain information could be obtained how the land had been injured. The ground, above the pines, was cleared for tobacco, and the pines on the exhausted spot, cut down, and suffered to lie, that their decay might produce some improvement. An intention was entertained, at the time, of adding other manures; but that was neglected. After some years, the ground was covered with another crop of pines; but its other productions, such as weeds and grasses, indicated improved fertility. This second cover, was cut down also, and permitted to remain where felled; and, during the progress of its decomposition, the ground received some aid by the washing of the soil from above, (but in a very slight degree,) during the cultivation of the tobacco, which was tilled there every fourth year. Now there is a dense cover again springing up, where the pines were, but it consists of poplars, dog-wood, walnut, oak, sumach, &c.: not a pine is to be seen. The land seems so far ameliorated, that with a slight manuring on a few spots weaker than the residue, it may be added for the purpose of a crop, to that which is contiguous.

Strongly stimulating manures, will produce a

growth of weeds, where they are deposited, that seem entirely foreign to the soil, and such as are found no where else, in similar situations, without adventitious aid. The Jamestown weed, (*datura strammonium*,) and the poke (*phytolacca decandria*,) are, spontaneously, the produce only of the richest soils. Yet, if a horse or ox stable is placed on the summit of the poorest knoll, in a year or two an abundant growth of the Jamestown weed and poke, is found near them. The seeds are surely not conveyed there by the animals, and the origin of the weeds must be referred to the action of the manure on the lands. As no where else, on spots of similar fertility, do these weeds make their appearance.

A plant, well known to cultivators of tobacco in this country, by the name of cotton-weed, comes up the first year after the lands are cleared, in great numbers, about the fences, and on every spot not worked. If the timber is cut away, and the ground not cultivated, whole acres are sometimes entirely covered. In a year or two it begins to diminish, and soon after disappears sometimes entirely, and always to so great an extent, as to be scarcely noticed. It furnishes vast quantities of winged seeds, which are carried about in every direction by the winds, to the great annoyance of those exposed to them, and would cover the whole country, if it were capable of flourishing any where but upon lands recently reclaimed from the forest. I will add only one more fact, although many might be adduced, of a similar character, and I shall take that from a foreign country, to show the law is general. It is the striking one presented by the poor heaths and moss ground of Scotland, where white clover follows the application of lime to the surface, without seed being sown.

I do not presume to enter into the examination, *how* vegetation is produced by the action of stimulating agents on the earth's surface, with or without the agency of seed. Both are intrinsically equally mysterious; but one from being familiarly known, attracts little notice, whilst the other being much less observed, awakens curiosity in a higher degree, when the attention is called to it. The fact seems to me above question, that the earth possesses the capacity of being acted on by stimuli, and some agents have the property of exciting it, more than others, to put forth certain products.

It is interesting to agriculturists, because by attentive observation, the appropriate manures to each of our crops, may, perhaps, be discovered, and a great deal of labor saved, which is now wasted, by our operose and indiscriminate mode of manuring, while larger results may be obtained. Gypsum, for instance, possesses the power, in a remarkable degree, of stimulating the production of red clover; and no farmer will now doubt, that a bushel of it will produce more effect on an acre of that grass, than fifty or an hundred bushels of stable manure.

Bone manure seems to possess an analogous character. Sir John Sinclair, in the 'Code of Agriculture,' says, "from fifteen to twenty bushels of bone dust per statute acre, when drilled, have been found to surpass, both on light soils and on peat, the ordinary dressing of farm yard dung, and even to exceed pigeon's dung and lime in producing fertility.*"

He adds, (page 144,) "it is an immense advantage, (if bones are properly used), that a severe drought will not prevent a crop of turnips, even in seasons when all other manures fail.* A number of valuable animals are thus preserved from perishing, and manure obtained for the succeeding crops, in the rotation."

The introduction of manures, like gypsum and bone dust in agriculture, is analagous to the use of improved machinery in manufactures. Larger results are obtained, and the saving of labor is immense. Indeed, I apprehend we have a very imperfect idea of the capacity of the earth to produce articles useful for man: and when a highly scientific agriculture shall apply to each article, desired to be produced, its specific and appropriate manure, the capacity of the soil to sustain a large population will far exceed our most sanguine expectations at present. Bone manure has enabled England, formerly so largely an importer, to produce enough at home, for the subsistence of her people.† It is difficult to conceive a national advantage of more magnitude for her independence and happiness. I need not enlarge upon the blessings an improved system of cultivation would confer on Virginia; and how much better it would be for her sons, instead of crowding the already over-loaded professions of law and medicine, to devote themselves to agriculture, conducted on scientific principles. The increase of wealth would be immediate. But far more—men would be wiser, better, happier, for employing themselves in studying the phenomena of nature, amidst her richest beauties, and having their minds directed by a contemplation of the bounties that surround them, to the great Author of their being, who, (to use the beautiful observation of Franklin,) "blesses the labors of the husbandman, by a continued miracle wrought in his favor, as a reward for his innocent life, and virtuous industry."

* Code of Ariculture. Add. p. 142

* Such is the action of gypsum on most crops, where it is beneficial.

† Code of Agriculture. Add. p. 141.

For the Farmers' Register.

ON DIFFERENT BREEDS OF ENGLISH CATTLE.

Dear Sir.—Having desired my friend, Mr. Rush, on his late departure for London, to obtain such *authentic* information for me as he could, as to the best breeds of improved English cattle, I send you, herewith, a copy of a letter from the largest cattle breeder in England, on the subject; the publication of which, I think, will be acceptable to your subscribers.

Very truly yours,

J. Mason, Jr.

Georgetown D. C., Nov. 3d, 1837.

Extract of a letter from Earl Spencer, to R. Rush, dated December 1836, *Althorpe, Northamptonshire:*

I am so much interested in breeding cattle, that I never think it any trouble to write upon the subject, and therefore feel most happy in giving you the best information I can, upon it. I am, however, so much engaged with one breed, that I fear my authority would be disputed by the advocates of the other improved breeds in this country; but I will endeavor to give you as impartial

an opinion as I can. In my opinion, there are only four breeds of cattle in this country, upon which so much pains and attention have been bestowed, and in which so much improvement has been effected, as to render them worthy the attention of a stranger. These are the Devon, the West Highland Scot, the Hereford, and the Short-horned breed. The Devons have three varieties: the North, the Midland, and the South. The first, are an excellent breed, fattening very quickly, and producing the best quality of meat. They give, however, very little milk, and are of very small size; consequently, as it costs nearly as much to breed and rear a small animal as a large one, they are not calculated for those parts of the country, where the soil is good enough to produce larger cattle. I believe them to be the only cattle that can keep themselves in good condition, during a dry summer, on light and sandy land. The Midland Devons have not the same merits. The South Devons come to a larger size, and are the Devons generally used for draught. For this, they are excellent; but they are very slow feedders, and when at last fat, are far from being favorites with the butchers. The North Devons are, as I have said, the best calculated for light dry soils; but they are not fit for exposed and bleak situations. The West Highland Scot, is also an excellent sort of cattle. They are calculated for poor soils; but their merit is in bearing cold and exposure. The Devons would beat them as much in a dry, hot summer, as they would beat the Devons in a cold winter. I believe they do not produce much milk; but as the practice, in their native country, is to allow them to rear their calves on the foot, upon the sides of the mountains, and not to use them at all, I believe, as dairy cows, I am not able to speak positively on this point. They do not fatten very quickly; but when fat, the quality of the beef is excellent, and it bears a higher price in the provision market, than any other beef which is sold there. No one, I believe, has ever bred the West Highland Scots any where but in mountainous districts; and their size is so small, that it could not be advantageous to do so. The Hereford, are a very valuable, large breed of cattle, and cannot be surpassed for the purpose of grazing, in land of moderate or superior value. But they are the worst milkers of any of the English breeds, because they do not give so much milk as the Devons, and what they do give, is very poor.

In the Short-horned breed, there are three varieties; but all evidently of the same family: the Ayrshire, the Holderness, and the properly called Short-horned or Durham. The general characteristic of this family appears to be, that of being very good dairy cows. The milk they give is certainly not rich; but the quantity is very great. The Ayrshire and the Holderness, retain this characteristic in its original perfection. The Ayrshire having been located in a more northerly and cold climate, have fallen off in point of size, but retain the qualification of being very good dairy cows. The Holderness have kept the size of the breed, and possess, in great perfection, the propensity to give a large quantity of milk; but neither of these varieties have much tendency to fatten, or to produce oxen profitable to the grazier. The Short-horned, or Durham, having been located in the rich valley of the Tees, have acquired, from constantly feeding in rich pastures, the propensity to fatten, which the other two varieties want; and although they have fallen off in their value, as milch cows, yet they retain so much of the family characteristic, as to render them generally much better dairy cows, than are to be found in any other of the grazing sorts of cattle. This is so much the case, that much the *largest* number of the dairy cows, from which London is supplied, are of this breed. The dairy men tell me, that although they might find cows that would give more milk, yet they fatten so much easier than such cows would, that it answers to them to sacrifice a portion of the dairy produce, for the purpose of being able more profitably to dispose of the cows to the butcher, when they are no longer in milk. The Durham or Short-horned oxen, are fully equal to the Herefords for grazing purposes, and I think when great perfection in shape and quality is required, combined with large size, as in the case of striving for prizes, the Durhams will generally be found to be best. I am endeavoring to give you as impartial an opinion as I can; but it is right for me to tell you, that I am the largest breeder of short-horned cattle in England. With respect to other breeds of cattle, they are hardly worth mentioning. The Galloway is a good sort, but its merits are of the same nature as those of the West Highland, and very *inferior* in degree. The Alderney milk and cream, is a great luxury from its richness; but the cattle possess no one qualification which a grazing animal ought to have; and I believe no one who farms for profit, ever has Alderney cattle. The Suffolk, produce probably as much milk as the Holderness, and of the same poor quality; but they are inferior to them in size and propensity to fatten, to the greatest possible degree. The Glamorganshire, and indeed all the Welsh cattle from being very cheap, are frequently purchased by the graziers; but no man who has ever tried any of the improved breeds, and can afford the out-lay of capital necessary to buy them, ever continues to graze Welsh oxen. The Lancashire, are a thick-hided, coarse race, with bad quality of flesh, and having no merit of which I am aware; and the Suffolk, though good, are only an inferior variety of the Devon.

For the Farmers' Register.

OBSERVATIONS ON THE AGRICULTURE AND HORTICULTURE OF WESTERN NEW YORK.

(Continued from page 441.)

The soil of the interior of New York is well known; and is not perhaps to be surpassed either in fertility or durability, by any tract of similar extent, in the United States. In some of the contiguous states, and in other parts of the same state, the system of agriculture is doubtless more perfect. Where nature has been less bountiful, a greater necessity has existed for man to exercise his industry. Improvement being once begun, a spirit of emulation carried it on; and every farmer felt a pride in at least keeping pace with his neighbors. Such are the circumstances under which some of the finest districts of Pennsylvania and eastern New York, have attained their present state of productiveness, which, under an opposite treat-

ment, would long since have become impoverished, and turned out as waste land. But the soil of western New York has borne up, and may long continue to be extremely productive, under a rigid system of exaction. Even in the oldest settled districts, the fertilizing properties of the soil exist in full vigor, without ever having received material aid from the proprietors. Relying, as they do, on its natural strength, which, indeed, can scarcely fail them in the most disastrous season, the most abundant crops continue to be grown, whilst the gratitude for such unmeasured bounty has not been manifested by making that careful return to the land, which, in less favored countries, is necessary to perpetuate its fertility. Such being the course of cultivation, some of the distinguished agricultural writers of that state have apprehended that the soil might shortly suffer a rapid deterioration, by the abstraction of the particular food, necessary to the growth of their chief staple. Judging, however, from the quantity of lime in the land, it may be regarded as almost inexhaustible; and all fear, therefore, of its becoming impoverished for a considerable length of time, must arise from ignorance of the fertilizing ingredients which enter into its composition. But it is the part of wisdom to look ahead, and to provide in time against the possible occurrence of such a contingency. If western New York would continue to be the granary of an immense extent of country, the productiveness of its soil should not only be maintained unimpaired, but every effort should be used to increase it. It cannot be denied, that, bountiful as nature has been, the products of the soil might even now be much enlarged, by a judicious use of putresent manures, and by occasionally giving an additional supply of lime, to repair the gradual waste occasioned by the heavy cropping to which the country has been subjected. So little necessity has yet existed, however, for the application of lime, that its value and importance cannot be supposed to have claimed general attention. Indeed, it is more than probable, that but a comparatively small number of persons are fully aware of the source whence the fertility of the soil is derived. But amongst the intelligent cultivators, an interest has been awakened on the subject; and experiments have been made to ascertain its effects, even on lands already highly calcareous. Should the result be found as beneficial as is anticipated, a stimulus will thus be given to a more extended application; and the example of practical agriculturists will doubtless be followed by a people alive to their interests.

The limestone lands of New York may be estimated as capable of producing on an average from twenty to twenty-five bushels of wheat per acre. In some instances, as much as forty have been grown, and an approximation to this might be more frequently realized, if the system of farming, were, in all respects, judicious. Of oats and corn, the yield may be from fifty to seventy-five bushels. There is, however, not that appearance of luxuriance in the crops, which we have been accustomed to see growing on lands made rich by manure alone. A traveller, therefore, in passing through the interior of New York, would feel some incredulity, or at least surprise, on being informed that the fields within his view would yield the above mentioned quantities, unless he had some knowledge of the products of calcareous soils. It appears to be an admitted fact, that the action of lime does not tend to increase the quantity of straw in the same proportion that it imparts nourishment to the grain. For this reason, the effect of putrescent manures on calcareous lands, is not so obvious in the appearance of the crop while growing, as it is in the product, when it comes to be measured. The most productive lands in eastern Virginia, can never, except under the most favorable circumstances, be relied on for a greater return than twenty bushels of wheat, and forty or fifty of corn to the acre, accompanied, in most cases, by a vast amount of straw or stalks; while these are the minimum products of land containing any considerable portion of lime, and the quantity of straw such as to promise only an indifferent product of grain.

The most serious evils which the farmers of New York have to contend with, in regard to the crop of wheat, are, the liability of the plants to be winter-killed in so rigorous a climate, and the prevalence of that formidable pest, the Canada thistle. The Hessian fly is only to be dreaded on lands of inferior quality; and the rust or blight is induced only by extraordinary seasons, when the period of harvest is protracted beyond the usual time. The comparative exemption from the rust, is doubtless to be ascribed, in part, to the calcareous nature of the land, which does not promote the too luxuriant growth of the stem. To overcome the effects of climate, the culture of spring wheat has been partially adopted in some districts within the last few years; and the results, in most cases, have been highly encouraging. It is a beautiful crop, and is readily distinguished from the other varieties. The success which has attended the culture of this grain in New York, has caused it to be introduced into more southern climates; and the most sanguine expectations have been formed of its advantages, without duly considering the character of our seasons. But even there, the spring wheat is rejected by many: and if it is profitable any where, it must be so in a soil and climate so propitious, where the scorching rays of our southern sun, which frequently dry up our latter grain, are seldom felt; and where an excess of moisture, so far from producing an over-growth of straw, and its consequent attendant, the rust, is accompanied with no other ill effect than a temporary suspension of the labors of the farmer. Although the spring wheat succeeded so well in Virginia, and even farther south, during the past season, yet it should be borne in mind, that in many of its features, that season was like a northern summer; and it should not be hastily inferred from thence, that this wheat will do equally well during a series of years. On the contrary, the successful results of repeated trials should be regarded as indispensible to the general adoption of this crop, in the agriculture of the south. It is true, our discouragements have been very great; and it is natural that almost every alternative should be resorted to, by our farmers, which may promise relief from the continued failures of the wheat crop, like those we have been subjected to, for the last four or five years. But, on the other hand, let us not despair. It is not to be supposed that these failures are to be of lasting duration. And even if they are, the season that would destroy one crop, would also destroy the other, except in so far as one of them would be

exempt from the action of the winter's frost. It is an old remark, founded upon accurate observation, that seasons of the same character cluster together. Until the last few years, our crops of wheat were abundant, and of good quality. Their failure cannot be ascribed to any other cause, than the unfavorable seasons; and by no means, as some have supposed, to a sudden deterioration of the soil. From the character of the last winter and summer, we may now reasonably conjecture that more propitious seasons are at hand, and that the eyes of the farmer will once more be gladdened by bountiful crops. It is earnestly to be wished that the spring wheat may realize the most sanguine expectations; but it is greatly to be feared, even if it should be found fully to succeed, that its introduction may bring with it a pest, which will more than counterbalance all its advantages. If the Canada thistle should ever effect a lodgment in Virginia, where we have so much waste land, it will be impossible ever to eradicate it. This species of thistle is a congener of our common downy thistle, (*cricus lanceolatus*), and has so little preference in regard to soil, that it flourishes equally well in all situations. It is a perennial plant, and every effort to destroy it, either by digging up the roots, or cultivating the land, serves only to invigorate it. It abounds extensively in New York, though happily its progress is partially arrested by birds exclusively seminivorous, which feed on it in great numbers. It was first discovered in Canada, by a jesuit, who, thinking it might be an acquisition to his botanical friends in Europe, transmitted it thither; and from this small beginning, it has spread over England, and several portions of the continent, where it is known by the appropriate name of the "cursed thistle."

The small size of the Indian corn on lands so fertile as those of New York, is calculated to excite a feeling of surprise. It may, in part, be owing to the influence of climate, but in some measure, and perhaps chiefly, to the character of the soil. A field which came under observation, containing two varieties, namely, the Dutton, and a kind from Vermont, exhibited a greater growth of the latter than of the former, though if climate had alone operated, the relative size should have been reversed. The southern varieties are difficult of acclimation, and attain a much larger size than those in general cultivation; but this might be expected to continue only for a few years, and may be attributed to the constitution of the plant, which cannot at once, adapt itself to the change. On the other hand, the small northern corn, when brought to our southern climate, is at first small, but gradually increases in developement, until, after a due course of cultivation, it exhibits the gigantic proportions of our own varieties. The opinion has been entertained, that the introduction of seed corn from the north, to take the place of the large southern kinds, together with the consequent change of culture from thin to thick planting, would be followed by an increased product. Experience, however, does not sanction the correctness of this opinion, except on land of the best quality. The close planting, which is requisite in the small kinds, to produce a full crop, would here be attended with disastrous consequences, in a dry season. Under a similar constitution of soil, the result might be more favorable; for the small varieties are certainly more productive than the large, under circumstances equally conducive to the growth of each. The size of the ear is greater in the former, in proportion to the stalk, than in the latter; and the number of stalks is multiplied several times beyond the closest planting that is ever practised in Virginia. When the corn attains its full size, it is difficult to distinguish the rows, and the field is then termed "a swamp." If the crop is sufficiently luxuriant to merit this appellation, a heavy yield is anticipated. The largest product to the single acre in Virgina, has, perhaps, seldom exceeded seventy-five bushels, after the utmost care and attention have been bestowed in the preparation of the land. On the calcareous soils of New York, from seventy-five to one hunured bushels are frequently gathered; and, in some remarkable instances, as much as a hundred and twenty, and even a hundred and fifty, have been obtained. The chief obstacle to the production of full crops, is, the shortness of the season, and the consequent liability to early autumnal frosts. Of late years, the corn has been materially injured from this cause; but when the earliest varieties come to be generally cultivated, less danger is to be apprehended. The crops are seldom affected by drought.

The product of oats is extremely abundant. They are more extensively cultivated than corn, as they constitute the principal grain for horses. Peas mixed with oats, are a favorite food for hogs: whole fields are sown broad-cast, the oats serving to support the vines, or rather to prevent them from trailing on the ground. It is the larger varieties of the garden peas that are used in field culture, and the product is about twenty-five bushels to the acre. It is objected to them, however, that swine are so fond of them, as to acquire a distaste for other kinds of food.

The system of agriculture, in the interior of New York, is so different from that which is practised on the eastern side of the mountains, that is difficult to institute a comparison between them, with a view to practical results. Here, we have, or ought to have, a regular rotation of crops, as indispensible to the improvement of our lands. The field that is now in wheat, must be followed by clover, the ameliorating effects of which during a rest of one or two years, are intended to prepare it for an undiminished, perhaps increased product, when it is brought into cultivation again, assisted by the auxiliaries of plaster and manure. It follows, therefore, of necessity, that a considerable part of every well managed farm—say from one-fourth to two-fifths—must lie in an unproductive state, which is equivalent to an unproductive investment of that portion of our capital. The practice of this system exists in the nature of our soil; and where it is not adhered to, the penalty of ultimate impoverishment must be paid, as our extensive waste lands too plainly demonstrate. On the calcareous lands of New York, no such nurture has been found necessary. None of the fields, on any of their farms, are suffered to lie at rest, for the purpose of acquiring renewed energy; but every acre is in profitable cultivation, either for grain or meadows—a judicious alternation of crops being scarcely attended to, or even thought of. Allowing, therefore, that one of their farms was three-fifths of the size of ours, and their land of the same quality, their profits would be the

same that are realized in our grain districts. But when we consider that their lands are four or five times as productive as ours, the great advantage that is thus enjoyed in the saving of labor and expense, with the increased amount of products, is at once obvious; and conclusively shows how their farmers become independent and even rich, by the cultivation of one hundred or one hundred and fifty acres. A farm of this size, by the above estimate, may be regarded as equal in value and profits to one of six or eight hundred acres, of the medium lands of Maryland and Virginia, under good management. These remarks, also, may show the absurdity of recommending small farms as the most profitable to our agriculturists, in imitation of those at the north. Small farms can only answer where the materials for enriching the soil are at hand, both mineral and vegetable. When one acre can be made permanently as productive as three or four were before, our extensive farms may be divided to more advantage. But under present circumstances, and with our species of labor, we shall be obliged to make up in quantity what we lack in quality, satisfied with gradually improving the soil, or, at least, keeping it up to its original fertility. Lime is unfortunately beyond the reach of a considerable portion of the farmers of eastern Virginia, however desirous they might be to use it. In one district, however, it is accessible in the form of marl, to a large extent of country, where it seems to have been deposited for the purpose of rescuing that beautiful region from the curse of sterility, and of adding incalculably to the many natural advantages it already enjoys. If it should be duly appreciated, a century hence may see a wonderful change wrought upon its surface, and hail it as the garden spot of the Atlantic states.

From the denseness of the forests of New York, the clearing of land is a business of great labor, which is often materially increased by the quantity of rock to be removed. The preparation of the soil is also rendered more difficult by the irregularity of the surface, caused by the blowing down of trees by the roots, and thus forming what are termed "cradles." These cradles have to be filled up, and the corresponding mounds reduced, before the land is ready for the reception of a crop. In many places it is now the work of years to prepare a piece of new ground for cultivation. After the wood is taken off, the stumps, too thick to admit the passage of the plough, are left to decay; but, in the mean time, excellent pasturage is afforded by the natural grasses. In two or three years the roots are sufficiently weakened to admit of the easy extraction of the stumps. During the early settlement of the country, however, the wants of the inhabitants compelled them to adopt a more speedy process, and to encounter difficulties in the preparation of the land, which must have been extremely discouraging to any but the most industrious and enterprising race. Girdling, the usual practice of early settlers, was necessarily resorted to, and other parts of the operation were probably performed in a hasty manner. A field in Cayuga county, of four hundred and eighty acres, was thus opened in one year for the cultivation of wheat, which produced the enormous crop of forty bushels to the acre. The memory of an achievement that bespoke so much energy of character, is perpetuated in the name of the place, which is called "Great-field," to the present day. It was a far greater triumph over nature than that which has been recently extolled in the public papers, as having been made in Michigan, where a thousand acres of prairie land had been broken up and laid down in wheat, by the efforts of one company.

The champaign appearance of the country, would lead a traveller to suppose that there might be a deficiency of timber; and the temptation to bring the greatest quantity of land into cultivation that can be spared, must be very great. The roads scarcely ever pass through the woods in the older settled parts, so that the reservations of timber lands are always in the rear of the farms. This disposition shows the various improvements of the country to infinite advantage. From the amount of timber in the forests, and the rapidity of its growth, it is only necessary to reserve a small proportion for the uses of the farm. The greatest economy is practised in the consumption of fuel. The winter's supply is cut during the summer in time for it to partially season, and afterwards deposited in wood-houses, to be used as wanted. The construction of the houses is also adapted to the practice of economy in the use of fuel. The rooms are small and very close, and fire places have been superseded in a great measure by stoves. Where the winters are so long, and the summers consequently short, and where land is so extremely valuable, it becomes doubly important that every operation should be managed with the strictest regard to a saving of labor, and that the products of the forest should be carefully preserved from waste. Notwithstanding the protracted winters, the quantity of fuel consumed in New York by a given number of families, is probably not half so much as is used by the same number in the southern states, where the crackling fire, the capacious fire place, and wide stretched door, are so often seen in the same apartment. Trere is also less timber used in the construction of fences, than in those places where the worm-fence is in use. If there was no other objection to the worm-fence, the space it occupies would constitute a sufficient motive for disusing it in a country where every foot of land is an object of regard, and where the divisions between the fields are so numerous. But to establish it, and keep it in repair, requires an amount of timber much greater than a direct line of board fence, or post and rail—four or five rails serving instead of twelve or thirteen in a worm-fence. An ordinary post and rail enclosure, however, might not be a sufficient safe-guard against the depredations of swine, if these mischievous animals were suffered to roam at large; but fortunately they are mostly confined in orchards, or in styes. For other kinds of stock, it will amply suffice.

In connection with the agriculture of New York, some notice of the mills at Rochester, for the manufacture of flour, may not be out of place. Rochester is situated at the falls of the Genesee river, and commands an extent of water power almost unrivalled. The falls are ninety-six feet perpendicular. and a long line of mills is erected immediately below, rising from the bed of the river, to above the summit of the bank, against the walls of which they rest. The buildings are therefore considerably more than a hundred feet high, which allows fall enough for the water to

be used, as in fact it is, two or three times, before it is finally discharged into the river. A canal, common to all the mills, conducts the water in front of the doors, and is extended on the erection of a new mill. It is a fortunate circumstance that this immense water power should exist in the midst of an extensive wheat growing country, and on the margin of the Erie canal, with every facility for the reception of grain, and the shipment of flour to the Atlantic cities. From Rochester, there is also a lateral canal taken up the valley of the Genesee river, and a rail road to Batavia.

The agricultural enterprise of New York has received a powerful stimulus in the Erie canal, which traverses the state from east to west, a distance of more than three hundred miles; and in the numerous lateral branches which are connected with it. Without this improvement, there would have been no outlet for the produce of that fertile country; and it would have remained, like a giant with his limbs in fetters. With it however, no country has ever made more rapid strides in population and wealth. It is already found to be too small to furnish a prompt and ready transportation for the increased amount of product and merchandize; and it is accordingly, under a process of enlargement. Internal improvement and agricultural enterprise, reciprocally acting on each other, have developed resources which even the projectors of this work could not distinctly have foreseen. The products of the state have been many times multiplied in value and amount, while the revenues derived from the public works have filled the treasury to overflowing. The successful enterprise of New York has naturally stimulated other states to imitate her example, and to project systems of internal improvements on a scale of similar grandeur. But it is next to impossible that any of them can ever derive the same profits. The existence of an immense back country of inexhaustible fertility has been wanting to insure results equally successful to new undertakings. Posterior improvements, therefore, have been in some instances an actual expense, instead of a profitable investment. The order of things has been reversed. The back country was to be enriched, or in other words to be *made*, while in New York, it had already been perfectly formed by the hand of nature. If this diversity of circumstances has not been properly considered in every new enterprise, still we are warranted in believing, that ultimate good will be effected.

Along the whole line of the Erie canal, numerous and flourishing villages have sprung up and every thing bears the impress of industry and prosperity. Its complete success, and the triumph it has achieved over former prejudices, and the asperities of party spirit, vindicate the right of its projector to be considered as one of the wisest and most distinguished men of his age. It is no longer termed in derision, as it was formally "Clinton's big ditch;" it is now "Clinton's noble line, more immortal than any of Homer's."

Of the state of horticulture, in the western part of New York, not much can be said. The improvements in this department, have by no means been commensurate with the progress that has been made in the more useful branches of industry; and the deficiency is rendered the more obvious by the contrast which exists between these and kindred improvements. Mens' minds are yet too deeply intent on the acquisition of wealth, for matters of mere taste and luxury to be an object of much attraction. In our new countries the necessaries of life must first be sought after and obtained, before much attention can be devoted to its comforts and elegances; and even in those which are comparatively old, the unsettled state of the population, the continual changes in the possession of property, and the consequent removals to distant regions, exercise an unfriendly influence on the progress of horticultural improvement. In the United States, there is no abiding place for our citizens; restlessness and locomotion are their chief characteristics. In England, on the contrary, where local attachments are stronger, and where the same occupants and their descendants remain on the same spot for a length of time, the inducement to rural embellishments is greater. The children inherit from their parents a taste for the elegant and ornamental, and every garden and cottage bears the evidence of neatness and taste. No part of the United States, therefore, can be compared to England for the interesting combination of the beautiful with the useful; nor can the more recently settled portions of this country exhibit the same progress that has been made in those of an older date. If these observations are correct, it is not to be expected that the interior of New York, has yet evinced much predilection for horticultural taste. The neatness and elegance and comfort of the dwellings are deserving of all praise. In the innumerable towns and villages which meet the eye in almost every neighborhood, and in the splendid churches, equally numerous, are beheld the decorations of architecture, and all the artificial appliances of worldly comfort, accompanied by no general improvements in the science of horticulture. The commodious and handsomely finished farm houses lose half their charms, by their want of contiguity to extensive and fruitful orchards, and by the almost entire absence of ornamental trees and plants. Apple orchards it is true, of greater or less extent, are found on nearly every farm; but there is no general cultivation of a variety and succession of fruits. The peach, the apricot, and the pear, the cherry and the plum, the strawberry and raspberry, are strangers, one might suppose, which would not always be recognized by a portion of the inhabitants. The contracted dimensions of the yards and gardens, but especially of the yards, are out of all taste; and impart an aspect of nakedness to the buildings, which like some other objects, lose half their attractions, by too great exposure to the eye. A yard of sufficient size, set in a verdant truf, and juciously planted, with handsome and well grown trees and shrubbery, is an indispensible auxiliary to the elegance of a rural mansion. It affords the only mode by which the proper degree of light and shade, concealment and exposure, can be happily effected; and ofientimes lends an indescribable charm, when other things are wanting. This parsimony in the laying out grounds is in strange contrast with the expenditure which has been lavished on the buildings, and with the liberal appropriation of land in the location of roads.

There is probably no distinct in the United States susceptible of a higher state of horticultural as well as agricultural improvement, than western New York; certainly no soil could be better adapted to most of the delicious productions

above enumerated, and to a great variety of plants deserving of culture for their beauty alone. As soon as they are committed to the earth, they begin to repay the labors of planting, by the rapidity of their growth. A few years would suffice to effect a wonderful change; as an impulse has been given to the work, by the example as well as writings of men of taste and science, it is expected that it will not be long before the arts of horticulture are more generally practised. Nothing exercises a more favorable influence on its advancement than the establishment of nurseries. They naturally create a desire for the possession of fine plants and fruits, by affording the ready means of gratification. As yet, the number of these is inconsiderable, so far as any information could be obtained; but that of Asa Rowe, near Rochester is of considerable extent, and conducted with great neatness and taste. At Albany, the long-established nurseries of Buel and Wilson, are well known, and are capable of supplying an extensive demand. The fidelity of all these gentlemen is unquestioned. The nursery business, however, as conducted in the United States, is not always managed with that precision by which it should be characterized. New fruits are extensively propagated and sold under imposing names without allowing time to ascertain their merits; and even the older varieties are not at all times propagating from fruit-bearing trees. After the lapse of a few years, when the young trees have been distributed over the county and nursed with the greatest care—and when anticipation is to be succeeded by enjoyment—they are oftentimes found to be of so little value, as to be an actual cumbrance to the ground. By such a loose practice, the vender, who imprudently commits himself on the faith of another, inflicts an injury on his customers, which it is impossible to repair. There are probably few extensive nurseries in this country, which can guarantee the identity of their fruits. The general distrust in their accuracy, has probably contributed not a little to retard the extension of horticultural enterprise. If the business were elevated to that state, which its importance justifies and demands, no species of fruit would be sold until its merits had been actually tested; and standard trees of every variety would be cultivated on the grounds of the nurseryman from which alone his scions would be taken. If this should be thought too tardy a process for the impatience of the seller, as well as the purchaser, yet it must be confessed, there is no safety in any other course; and the nurseryman who established his reputation on his fidelity and accuracy, will ultimately find it to redound to his own interest, to adopt this system, not less than to the interests of those who entrust him with the execution of their orders.

Amongst the numerous objects which claim some share of horticultural taste, may be enumerated the public burial grounds, which are situated on the sides of the roads, neatly enclosed and covered with a luxuriant sod. Notwithstanding the melancholy purpose to which these spots are dedicated, their neatness, and cleanliness from all weeds and unseemly plants, make it pleasant to look upon them, and witness the attention that is bestowed to keep them in order. The neglected state of the repositories of the dead in nearly all parts of our country, is a reproach to a civilized people. In the neighborhood of cities, they are sometimes, though not invariably, the objects of some care—reluctant though it be; but in the country, those of a private as well as public description are either filled with briers or other noxious plants, or exposed to the continual intrusion of cattle. A better feeling has prevailed in New York, where a public burying ground is laid off for the use of every township, and a particular appropriation made to preserve it from injury. As far as the duties of the sexton extend, they appear to be performed with commendable fidelity—no mounds of fresh earth indicating the recent interments: but the beauty of these lovely spots would be greatly enhanced by being set with a suitable number of appropriate trees. These simple and natural emblems have, from time immemorial, been recognized as peculiarly adapted to the solemnity of such scenes. The cemeteries of Turkey, covered with the mournful cypress which is planted by the priest on every grave, have suggested the plan of the celebrated *Pere la Chaise* in Paris, from whence has been subsequently derived the model of those of Mount Auburn and Laurel Hill, at Boston and Philadelphia. There is a melancholy pleasure induced by the contemplation of the pendent willow and ever verdant trees flourishing over the remains of mortality; and the mind, instead of being repulsed, turns with a pious interest to the sacred repository so nearly connected with the inextinguishable affections of our nature—which in a few short years is to offer an asylum of rest to our own wearied and exhausted limbs.

[After the first part of our correspondent's communication, in No. 7, had been printed, we received from him, as specimens of the small pebbles which form a large part of the very singular ridge, south of the Lake Ontario, and which is described in the second column of page 441. The pebbles were completely encrusted with a thin hard coating of carbonate of lime (tested by its solution in acid,)—and the same substance had even penetrated and filled the interior pores of two of them, which were of a porous and soft texture. Another was a close and hard silicious pebble, of which the lime only covered the surface. The accompanying note of our eorrespondent, state that "the quantity of lime deposited on them extends through the whole mass, [of the ridge,] as far as I had an opportunity of observing. I think we may suppose that the adjoining lands received quite as great a deposite. But this, however is not from the limestone region of the state."

The inference of our corrrespondent, that all the adjacent lands, of a higher elevation, must have been equally furnished with calcareous matter, by the then covering limestone waters, is inevitable. And the curious fact serves to show, on a large scale, how nature has operated to give to the soils of some regions the ingredient of lime, so necessary to productiveness. If the contiguous arable soil was examined by chemical tests, we presume that it would be found that none of the *carbonate* of lime now remains; and this would furnish an additional and very striking proof of the truth of our doctrine of the disappearance of *that form* of lime, and of the formation and constitution of *neutral soils*. See 'Essay on Calcareous Manures,' 2nd ed. ch. vii.—Ed. Far. Reg]

For the Farmers' Register.

RAT PROOF SMOKE-HOUSES.

In conversation with a friend, sometime since, I was surprised to find that he had never heard of any plan of construction, for a smoke house, which would render it proof against rats, and that he did not think, there was one such house in his county, Albemarle, which, in an agricultural point of view, ranks among the foremost in the state. This reminded me of a remark often repeated in our agricultural journals, that there are many matters in very common use, in some localities, of which the public at large know nothing, and from which no general benefit is derived. A recollection of this conversation, now reminds me of another thing, which produces some shame. This conversation occurred two or three years ago; and though I was able to suggest two plans for the construction of rat-proof smoke-houses, and was fully resolving, as soon as I got home, to communicate them, for the "Register," yet I have deferred it, from time to time, until the present. This is the way we all do; but better late than never.

The house should be raised about three feet from the ground and rested on a wall, or on pillars: it should have a floor of thick strong plank, closely laid, with a hole cut in its centre, about four feet square, under which, should be a close strong wall of brick or stone, forming a pit in which to build fires for smoking. The door, weather-boarding, cornice and shingling, should, of course, be so close as to prevent the entrance of rats. For the sake of cleanliness and safety from fire, the floor should be covered over several inches deep with sand and well paved with brick, flat stone or pebbles. If it is deemed important to save the mistress of the household from the trouble of personal attention, whenever a smoke is made, a flue may be constructed, extending from the central pit, far enough beyond the outer walls of the house, to avoid the danger of fire. In this case, strips of sheet-iron should be placed on the walls of the pit, jutting over in such a manner, as to prevent rats from climbing into the house, should they pass through the flue. A house construeted in this way, if well made, will effectually keep out rats, and the additional expense incurred beyond the ordinary cost of a smoke house, but litttle, if at all, transcends the loss frequently sustained from the depredations of rats, in one year.

The same end may also be obtained by making the sills of the house so deep, that space enough may be allowed for counter-sinking its strong sleepers sufficiently low down to give room for a good bed of sand and a good pavement above the plank floor, and beneath the upper surface of the sills.

Or, perhaps the cheapest plan would be to give to the house a good under-pinning of stone and lime mortar, sunk in the ground to a good foundation—to dig out the earth on the inside to within a few inches of the bottom of the wall, then pave with stone and lime mortar, and throw upon the pavement suitable clay or earth for making a good dirt-floor, and ram it well. By this plan, the expense of sleepers and a plank floor is saved, and the barriers against the rats, seem to be equally effectual. A gentleman recently showed me such a house, which, though new, had so far, perfectly fulfilled expectations. The floor was a foot or two below the top of the wall, and strong planks were laid upon the sills at each end of the house, forming shelves, on which barrels and other lumber could be placed, and affording an airy space beneath, which was neatly swept, where no straggling rat could find a hiding-place, should one accidentally gain admittance. The under-pinning of this house, and the floor, as my friend assured me, were made by the laborers on his farm; and although a little rough, would, as I felt convinced, answer the purpose intended, as well as the neatest masonry. The foregoing subject is acknowledged to be humble; but I do not consider myself exonerated from the obligation to contribute my *mite*, merely because I feel unable to instruct in the higher concerns of agriculture. Humble, however, as it may be, it is also important. Our brethren in Pennsylvania, I have learned, when first settling a farm, *de novo*, build excellent outhouses, before incurring much expense on the dwelling, and are never satisfied until all their buildings are good. Were we to imitate them in this, we would doubtless think more of improving our lands, and be less tempted to expatriation.

The stale witticism, that "the best way to make your corn house rat-proof, is to keep it empty," may also be applied to the meat-house. But those who have comfortable experience in both rat-proof corn and meat-houses, feel that "he who wins, may laugh," and can well afford to leave to the jokers, their hearted corn and hollow ham-skins.

For the Farmers' Register.

BEAVERS ON THE NOTTOWAY RIVER.

Another small matter, which has not, to my knowledge, been communicated to the public, is the fact, that beavers live, in great numbers, on the Nottoway river and its tributaries. Not residing in that region, I am unable to afford much minute information on the subject. Should the editor of the 'Register' think it sufficiently important, I suppose he may easily investigate the matter more fully.

While at the house of a friend in Lunenburg county, several years ago, I observed the fresh tail of a beaver nailed to a tree in his yard. He told me, the animal was shot a few days previously by a member of his family, and assured me, that there were many of them on the river before mentioned, and, I think, remarked that they were rapidly increasing. The hunters for them lie concealed on the bank, before day in the morning, and shoot them with large shot; such as are not very suddenly killed, are almost certain to escape, by diving under the water. It was also stated to me, that they were frequently baited with poles and limbs of the young sweet-gum, being very fond of eating its inner bark. Many of them are caught in traps, which were imported for the purpose, by Messrs. Van-Lew and Morton, of Petersburg. The number of such traps, sold by these gentlemen, was stated to be great; but is not distinctly recollected. The most curious fact in relation to these animals is, that being compelled to live in a settled country, and finding themselves unable to indulge, without interruption, their wonderful propensity for building dams, they should have the sagacity to accom-

modate themselves to circumstances, and, like musk-rats and otters, resort to caves in the bank, for a habitation. A question might occur, as there is a probability that, from the progress of civilization, the beaver may become extinct, whether it might not be well, if practicable, to transfer them to other streams. The propriety of this, would depend on the habits of the animal, which, as far as I could learn, are harmless—and the prospect of their value. I saw somewhere, perhaps in one the earlier numbers of the 'Register,' that some gentleman in Ohio, had enclosed and tamed the otter, in a wall around a pond. The remarkable facility with which the beaver accommodates himself to circumstances, the superior value of his fur, and the great delicacy of his flesh, while young, might render him a more valuable member of civilized life.

From the Penny Cyclopædia.

ARABLE LAND,

So called from the latin word *arare* 'to plough,' is that part of the land which is chiefly cultivated by means of the plough.

Land in general is divided into arable, grass land, wood land, common pasture, and waste. The first of these is by far the most important in agriculture. In this article we shall briefly explain the principles on which are founded, the most improved methods of cultivating arable land, by which the natural produce of the soil is greatly increased, and many productions are obtained in perfection, which are foreign to the soil and climate.

We shall, first, consider the nature and properties of various soils.

2. The best modes of preparing and improving the natural soil, so as to increase its produce.

3. The most advantageous succession of crops, so as to obtain the greatest returns, with the least diminution of fertility.

Of soils.—When the surface of the earth is penetrated, we generally find that the appearance, texture, and color, vary at different depths. There is a layer of earth nearest the surface, of greater or less thickness, which covers the more solid and uniform materials, which lie below it. This may be particularly observed wherever there are natural or artificial excavations or pits. A distinct line, nearly parallel to the surface, generally marks the depth of the upper soil, and separates it from the sub-soil. The soil is more or less composed of minute parts of various kinds of earth, mixed with animal and vegetable substances, in different states of decomposition; and to these, in a great measure, it owes its color, which is generally darker than that of the sub-soil. Except where iron, peat, coal, or slate, abound in the soil, a dark color is an indication of corresponding fertility. The rich soil of gardens, long cultivated and highly manured, is nearly black. As the soil is the bed in which all vegetable productions are to be reared, and in which they are to find their proper nourishment, its texture and composition become objects of great importance to the cultivator; and, without a competent knowledge of these, no practical rules can be laid down or depended upon.

All soils are composed of earths, * metallic oxides, saline substances, vegetable and animal matter, and water. The earths are chiefly clay, or alumina, flint or silica, and lime.

Magnesia, barytes, and other earths are occasionally met with, but in so few instances that they may be omitted in the list.

Of the metals, the most abundant is iron in the state of peroxide. The other metals are rarely found near the surface.

Saline substances form a small part of a soil, but an important one.

Potassa exists in almost every vegetable, soda in a few, and ammonia is produced by the decomposition of animal matter, but from its volatile nature it is not long retained in the soil, except when it forms a fixed compound with other substances.

The vegetable acids, as a general rule, are perhaps limited to small portions of acetic acid in combination with some base, as lime or potash.

The mineral acids are found united with earths and alkalies, in the state of neutral compounds.

These saline substances have a powerful effect on vegetation, and a knowledge of their proportions in the soil, and of their various qualities, is indispensible, in order to modify or correct their action, by other substances, for which they have an affinity.

Water, in a state of combination, or of mere mechanical diffusion, is essential to the growth of all plants; without it, and atmospheric air, there is no life, either animal or vegetable.

Of the earths.—Clay or alumina, so called because it is obtained in its purest state from alum, in which it is combined with the sulphuric acid,† is the basis of all strong and heavy soils. When it is minutely divided, it is easily suspended in water; when dried slowly, and stirred while drying, it becomes a fine powder, soft to the feel, and when kneaded with water, a tough ductile mass, easily moulded into hollow vessels, which retain liquids. This property, of being impervious to water, gives the specific character to clay as an ingredient of the soil. In a pure and unmixed state it is absolutely barren. When clay is heated to a great degree, it parts with the water combined with it; it is then said to be baked, as we see in bricks. It is no longer diffusible in water, and differs little from silica or sand, in its effects on the soil.

Silica, or the earth of flints, suffers no change in water. It consists of crystals, or fragments, of very hard stone, forming *gravel* or *sand*, according to their size; and the finest silicious sand, when examined with a magnifying glass, has the appearance of irregular fragments of stone, without any cohesion between them.

Silicious sand holds water in its intertices by simple cohesive attraction, in proportion to its fineness. It heats and cools rapidly, letting the water pass through it readily, either by filtration or evaporation. Its use in the soil is to keep it open, to let the air and water, as well as those other substances on which the growth of plants depends, circulate through it. Unmixed, it dries so rapidly that no vegetation can continue in it, unless a con-

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* We retain the old division, although the earths have been ascertained to be oxides of peculiar metals; but as they are never found in the soil in their metallic state, the results and reasonings are not affected by this circumstance.

† Sulphuric acid, commonly called oil of vitriol, is composed of sulphur and *oxygen*, which is the pure or *vital* part of the atmosphere. (See Air.)

stant supply of moisture be given by irrigation. A small portion of clay will much improve light sands; it takes a large quantity of sand to correct the tenacity of clay.

Lime, in its pure state, is familiar to every one as the basis of the mortar used in building. It is produced by burning marble, chalk, limestone, or shells, in a great heat. In the stones which are formed principally of lime, it is combined with some acid, most generally the carbonic acid, which separates from it by the operation of burning, in the form of an air or gas, hence called *fixed air*, from its being thus *fixed* in a stone. These stones of various degrees of hardness, are now all classed under the name of carbonates of lime.

Lime unites readily with water, which it also absorbs from the atmosphere. It then becomes *slaked*. By uniting with carbonic acid, it returns to its former state of carbonate; with this difference, that, unless much water be present, it remains a fine impalpable powder. Pure lime is soluble in water, though sparingly; a pint of water cannot dissolve more than about twenty grains: the carbonate is not soluble in water. Carbonate of lime has a powerful effect on the fertility of a soil, and no soil is very productive without it. It is consequently used extensively as an improver of the soil, otherwise called a *manure;* but its use in this respect, and the mode in which it acts, will be given in the articles "*manure*" and "*lime.*"

Carbonate of lime, as an earth, is neither so tenacious as clay, nor so loose as sand. In proportion to the fineness of its particles it approaches to the one or the other, and when the parts are large and hard, it takes the name of limestone gravel.

Its distinguishing feature, is its solubility in acids, which it neutralizes, depriving them of their noxious qualities in the soil. A proper mixture of these three earths, in a due state of mechanical division, forms a soil well fitted to the growth of every species of plants, especially those which are cultivated for food; and nothing more is required than a proper climate as to heat, a proper degree of moisture, and sufficient nourishment, to make all the plants generally cultivated thrive most luxuriantly in such a mixture, which is usually called a loam.

But there are some soils, which, besides a proper mechanical texture and mixture of earths, contain a large proportion of a natural manure, which renders them extremely fertile. This is a substance produced by the slow decay of animal and vegetable matter. It can be separated from the other parts of the soil, and has been accurately analyzed and described by many of the most experienced chemists, particulaly by Fourcroy, Davy, Chaptal, and Theodore de Saussure. (See '*Recherches Chimiques sur la Vegetation,*' Paris, 1804, 8vo.) This substance has been called *vegelable mould;* but, as this is not a very distinct term, we shall, after Thear and other eminent writers on agriculture, adopt the name of *humus* when speaking of it. Humus is a dark, unctuous, friable substance, nearly uniform in its appearance. It is a componnd of oxygen, hydrogen, carbon, and nitrogen, which, with the exception of nitrogen, which is found only in some substances, are the elements of all animal and vegetable substances. It is the result of the slow decompositions of organic matter in the earth, and is found in the greatest abundance in rich garden mould, or old neglected dunghills. It varies somewhat in its qualities and composition, according to the substances from which it has been formed, and the circumstances attending their decay. It is the product of organic power, such as cannot be compounded *chemically.*

Besides the four essential elements in its composition, it also contains other substances in smaller quantities, viz: phosphoric and sulphuric acids combined with some base, and also earths and salts. Humus is the product of living matter and the source of it. It affords food to organization. Without it, nothing material can have life. The greater the number of living creatures, the more humus is formed; and the more humus, the greater the supply of nourishment and life. Every organic being in life adds to itself the raw materials of nature, and forms humus, which increases as men, animals, and plants increase in any portion of the earth. It is diminished by the process of vegetation, and wasted by being carried into the ocean by the waters, or it is carried into the atmosphere by the agency of the oxygen of the air, which converts it into gaseous matter. (See Thaer, '*Grund-satze der Rationellen Landwirthshaft,*' Berlin, 1810, four vols. 4to.)

Humus, in the state in which it is usually found in the earth, is not soluble in water and we might have some difficulty in comprehending how it enters into the minute vessels of the roots of plants; but here the admirable provision of nature may be observed. Humus is insoluble and antiseptic; it resists further decomposition in itself, and in other substances in contact with it. It remains for a long time in the earth unimpaired; but no sooner is it brought into contact with the atmosphere, by the process of cultivation, than an action begins. Part of its carbon uniting with the oxygen of the atmosphere, produces carbonic acid, which the green parts of plants readily absorb; while its hydrogen, with the same, forms water, without which, plants cannot live; and in very warm climates, where this process goes on more rapidly, the moisture thus produced keeps up vegetable life, when rains and dews fail. The residue becomes a *soluble extract*, and in that state is taken up readily by the fibres of the roots. But the changes still go on; the extract absorbs more oxygen, and becomes once more insoluble, in the form of a film, which Fourcroy calls *vegetable albumen*, and which contains a small portion of nitrogen, readily accounted for. By bringing fresh portions of humus to the surface and permitting the access of air to it, more carbonic acid, water, extract, and albumen are formed, and give a regular supply to the plants, which, by their living powers, produce the various substances found in the vegetable kingdom of nature. Hence we see the great importance of frequently stirring the surface of the earth between cabbages and other vegetables.

It is to the patience and perseverance of the chemists above-named, that we owe this insight into the wonderful process of vegetable growth. What we here state is on their authority.

We can now readily understand the great importance of humus, and of those rich manures which are readily converted into it, when not immediately absorbed by plants. But it has still another property, highly important to fertility; it renders stiff clays porous, and consolidates loose

sands. It does so more than lime, or any other earth. Hence a soil with a considerable proportion of humus is much more fertile than the quantity of alumina, or of sand, in its composition would lead one to expect, as we shall see when we come to the analysis of soils of known fertility; and we see the great advantage of animal and vegetable manures, not only as nourishment to vegetables, but as mechanical improvers of the texture of soils.

The greatest enemy of humus is stagnant water; it renders it acid and astringent, as we see in peat; and soils abounding with vegetable matters, from which water is not properly drained become *sour* as is very justly said, and produce only rushes and other useless and unpalatable plants. The remedy is simple and obvious; drain well, and neutralize the acid with lime; by these means abundant fertility will be restored.

In very light soils, humus is seldom found in any quantity, being too much exposed to the air, and rapidly decomposed; the extract is washed through them by the waters, and as they waste manure rapidly, they are called *hungry*. Such soils are very unprofitable, until they are improved and consolidated by clay or marl, which makes them retain the moisture.

With calcareous earths, humus acts well, provided they are pulverized, and of sufficient depth. Some chalky soils are rendered very fertile by judicious culture and manuring.

In order to ascertain the probable fertility of a soil, it is very useful to analyze it, and find out the proportion of its component parts. To do this with great accuracy requires the knowledge of an experienced chemist; but, to a certain degree, it may be easily done by any person possessed of an accurate balance and weights, and a little *spirits of salts*, or muriatic acid. For this purpose, some of the soil, taken at different depths, not too near the surface (from four to eight inches, if the soil is uniform in appearance,) is dried in the sun till it pulverizes in the hand, and feels quite dry; the small stones and roots are taken out, but not minute fibres. A convenient portion of this is accurately weighed; it is then heated in a porcelain-cup, over a lamp, or clear fire, and stirred, till a chip or straw put in it turns brown. It is then set to cool, and weighed; the loss of weight is the water, which it is of importance to notice. Some soils, to appearance quite dry, contain a large portion of water, others scarcely any. It is then pulverized and sifted, which separates the fibres and coarser parts. The remainder, again weighed, is stirred in four or five times its weight of pure water; after standing a few minutes to settle, the water is poured off, and contains most of the humus and soluble substances. The humus is obtained by filtration, well-dried over the lamp, and weighed. The soluble substances are obtained by evaporating the water; but, unless there is a decidedly saline taste, this may be neglected. The humus may be further examined by heating it red hot in a crucible, and stirring it with a piece of the stem of a tobacco pipe, when the vegetable part will be consumed, and the earths remain behind; thus the exact quantity of pure vegetable humus is found. Some muriatic acid, diluted with five times its weight of water, is added to the deposite left after pouring off the water containing the humus and soluble matter; the whole is agitated, and more acid added gradually, as long as effervescence takes place, and until the mixture remains decidedly acid, which indicates that all the calcareous earth is dissolved. Should there be a great proportion of this, the whole may be boiled, adding muriatic acid gradually, till all effervescence ceases; what remains, after washing it well, is siliceous and argillaceous earth. These are separated by agitation, allowing the siliceous part to settle, which it does in a few seconds. The alumina is poured off with the water, filtrated, heated over the lamp, and weighed—the same with the silicious sand. The loss of weight is calcareous earth. In this manner, but with greater care and more accurate tests, various soils of known fertility have been analyzed, of which we will give a few examples.

A very rich soil near Drayton, Middlesex, examined by Davy, consisted of three-fifths of silicious sand and two-fifths of impalpable powder, which, analyzed, was found to be composed of

	Parts.
Carbonate of lime,	28
Silicious earth,	32
Alumina,	29
Animal and vegetable matter,	11
	100

This is a rich sandy loam, probably long and highly-manured, fit for any kind of produce, and if deep, admirably fitted for fruit trees.

Another good turnip soil, by the same, consisted of eight parts of coarse siliceous sand, and one of fine earth, which [nith part] being analyzed consisted of

Carbonate of lime,	63
Silica,	15
Alumina,	11
Oxide of iron,	3
Vegetable and saline matter,	5
Water,	3
	100

This is a very light sandy soil, and owes its fertility to the fine division of the carbonate of lime and the vegetable and saline matter. It may probably have been limed or marled, at some time or other.

The best loam in France, according to Mr. Tillet, consists of

	Parts.
Fine silicious sand,	21
Coarse ditto,	25
Carbonate of lime,	37.5
Alumina,	16.5
	100

A loam at Chamart, highly prized by gardeners about Paris, as the basis of their artificial soils, consists of

	Parts.
Argillaceous sand,	57
Finely divided clay,	33
Silicious sand,	7.4
Carbonate of lime, coarse,	1
Ditto, fine,	.6
Woody fibre,	.5
Humus and soluble matter,	.5
	100

The argillaceous sand is composed of fragments of soft stone, which retain moisture, and do not bind hard; the small proportion of humus is of no consequence where manure is to be had in any quantity.

A very rich heath or bog-earth found at Meudon, and in great request for flowers and in composts, consists of

	Parts.
Gritty silicious sand, - - - - -	62
Vegetable fibres partly decomposed, -	20
Humus, - - - - - - -	16
Carbonate of lime, - - - -	.8
Soluble matter, - - - - -	1.2
	100

This soil, like our bog-earth, would be very unfit for the growth of corn; but, from the quantity of humus and vegetable matter, is highly useful in composts and artificial soils; mixed with lime, it would make an excellent top-dressing for moist clay soils.

Mr. Thaer has given a classification of soils of known qualities, which, we think, worthy of notice. It is as follows:—

No.		Clay p. cent	Sand p cent	Carb. of lime p. cent.	Humus p. cent	Value.
1	First class of strong wheat soils.	74	10	4 1-2	11 1-2	100
2		81	6	4	8 2-5	98
3		79	10	4	6 1-2	96
4		40	22	36	4	90
5	Rich light sand, in natural grass	14	49	10	27	?
6	Rich barley land	20	67	3	10	78
7	Good wheat land	58	36	2	4	77
8	Wheat laud	56	30	12	2	75
9	Ditto	60	38	Very insignificant quantities.	2	70
10	Ditto	48	50		2	65
11	Ditto	68	30		2	60
12	Good barley land	38	60		2	60
13	Do. second quality	33	65		2	50
14	Ditto	28	70		2	40
15	Oat land	23 1-2	75		1 1-2	30
16	Ditto	18 1-2	80		1 1-2	20

Below this, are very poor rye-lands.

In all these soils the depth is supposed the same, and the quality uniform to the depth of at least six inches; the sub-soil sound, and neither too wet nor too dry.

Nos. 1, 1, and 3, are alluvial soils, and from the division and the intimate union of the humus, are not so heavy and stiff as the quantity of clay would indicate.

No. 4 is a rich clay loam, such as is found in many parts of England, neither too heavy nor too loose—a soil easily kept in heart by judicious cultivation.

No. 5 is very light and rich, and best adapted for gardens and orchards, but not for corn; hence its comparative value can scarcely be given.

Nos. 6, 7, 8, are good soils; the quantity of carbonate of lime in No. 8 compensates for the smaller portion of humus. This land requires manure, as well as the others below. In those from No. 9, downwards, lime or marl would be the greatest improvement. Nos. 15 and 16 are poor light soils, requiring clay and much manure. But even these lands will repay the cost of judicious cultivation, and rise in value.

The last column of comparative value, is the result of several years' careful valuation of the returns, after labor and seed had been deducted.

Few soils in England contain more than four or five per cent. of humus, even when in very good heart; and two per cent. with a good loamy texture, will render a soil fit for corn with judicious cultivation. The texture is of most importance, as may be seen by comparing No. 7 and 8 with No. 6. If this is of good quality, dung will soon give the proper supply of humus.

The depth of the soil and the nature of the subsoil greatly affect its value. However rich it may be, if there is only a thin layer of good soil over a sharp gravel, or a wet clay, it can never be very productive; in the first case, it will be parched in dry weather; and in the latter, converted into mud by every continued rain. If the subsoil be loam or chalk, six inches of good soil will be sufficient. With a foot of good soil, the subsoil is of little consequence, provided it be dry, and the water can find a ready outlet. The best alluvial soils are generally deep, the chalky, shallow.

The exposure, with respect to the sun, and the declivity of the ground, are very important circumstances, and equivalent to an actual difference in the climate. A gentle declivity towards the south, and a shelter against cold winds, may make as great a difference as several degrees of latitude; and in comparing the value of similar lands in different climates, the average heat and moisture in each must be accurately known. A soil very fertile in the south of Europe may be very unproductive in England; and a light soil of some value in the west of Scotland might be absolutely brrren in Italy or Spain.

From the Cultivator.

EXPERIMENT IN HARVESTING CORN.

We think it has been well established, in repeated experiments, that the old, and in many cases present practice, of topping corn, very considerably diminishes the quantity of grain; a result which vegetable physiologists had long ago proclaimed. Desirous of knowing how far the product would be diminished by cutting up the entire crop, at the ordinary period of topping, we invited the public attention to the subject in our March number, and have subsequently instituted a small experiment, the result of which we give below. We do not mean to intimate that this experiment is conclusive, though the result is such as we expected; and we therefore again invite gentlemen who may have experimented in the matter, to foward us the results, in order the better to arrive at a correct conclusion, in a matter, which is certainly of high interest to the farmer; for if other trials justify our conclusions, an immense loss is annually sustained by the practice of topping corn.

On the 16th of September we selected thirty-two hills of corn—being a good sample of two acres—in four contiguous rows, eight hills in a row, and topped them in the old way.

We selected thirty-two hills in like manner, adjoining the preceding, which we cut at the roots, and stooked, at the same time.

And we left thirty-two hills adjoining the last, to ripen on the entire stalk.

The parcels were apparently alike.

On the 9th of October, we picked, husked and weighed each parcel separately. The weight, and number of ears, of all descriptions, were as follows:

No. 1 standing weighed lbs 62¾, and had 239 ears.
No. 2 cut up, " 63¼, " 145 "
No. 3 topped, " 55½, " 135 "

We then equalized the number of ears, by taking four from No. 1, and ten from No. 2, leaving 135 in each. The weight was then as follows:

No. 1 standing, - - - 61¼ pounds.
No. 2 cut up, - - - 60¼ "
No. 3 topped, - - - 55½ "

The field having been planted precisely three feet distant between the rows, and about two and a half feet the other way, would average 5,808 hills on the acre. The acre would, therefore, according to the above results, give the following product in pounds:

The standing corn, - - 10,616 pounds.
The cut-up do. - - 10,436 "
The topped do. - - 9,982 "

It follows, that the loss by topping an acre would be 634 pounds; do. by cutting up 181 pounds; and that cutting up has an advantage over topping of 453 pounds, independent of the important gain in the forage.

We then shelled a bushel, which required 78 pounds in the ear,—the grain weighing 53 pounds and the cobs 25 pounds. When perfectly dry the corn weighs 60 to 62 pounds. Dividing the total pounds per acre by 78—the number of pounds of ears required for a bushel of shelled corn—the product in bushels, under the different modes of management, would be as follows:

Standing corn, - 136 bushels 8 pounds.
Cut up do. - 133 " 62 "
Topped do. - 127 " 76 "

Deduct ten per cent for shrinkage, on drying to a merchantable condition, and the product would then be as follows, omitting fractions:

The standing corn, per acre, - 122 bushels.
The cut off do " - - 120 "
The topped do. " - - 114 "

That our southern patrons may understand the cause of this great product, it will be only necessary for us to state, that in our mode of planting, we produce on an acre, if there are no deficiencies, as there need not be if plenty of seed is put in, 23,232 stalks, which on the assmption that each stalk produces an ear, and that the ears average a gill each, which is much under the mark with the Dutton corn, the product would be about 90 bushels. The southern corn, at four and a half feet distance, two stalks, in a hill, would give only about 4,300 stalks; now supposing this to be the Baden variety, giving four ears on a stalk; the total uumber of ears would be but 17,200 on the acre, or about 6,000 ears; or gills, less than our Dutton crop, with one ear on a stalk.

From the Cultivator.

TO HARVEST BEANS.

Lake County, Ia. 9th Oct. 1837.

The following simple and easy method of saving a crop of *beans*, is worth the price of ten years' subscription to the Cultivator, to every person that never practised it, who wishes to cultivate that valuable crop. By this method, beans may be planted in a field by themselves, may be pulled while the vines are entirely green; and will be perfectly cured, no matter how wet the weather; and what is more, need not be housed or thrashed until such time as may be convenient. This is the plan.

To cure beans.

Take poles or stakes, (common fence stakes) into your bean field, and set them stiff in the ground, at convenient distances apart, which experience will soon show you, and put a few sticks or stones around for a bottom, and then, as you pull an arm-full, take them to the stakes, and lay them around, *the roots always to the stake*, as high as you as can reach, and tie the top course with a string, or a little straw, to prevent them from being blown off, and you never will complain again, "that you cannot raise beans, because they are so troublesome to save." They are the easiest crop ever raised, to take care of. Try it, and you will then know it, and thank me for telling you of it.

Your friend,
SOLON ROBINSON.

For the Farmers' Register.

REMARKS ON THE ACCOUNT OF MR. SAMPSON'S FARMING. ON THE PROPER COMBINATION OF STOCK RAISING, WITH IMPROVEMENT OF SOIL.

The rich treat lately afforded me in the perusal of the account of Mr. Richard Sampson's farming, has pressed so heavily on my conscience the obligation to contribute my portion to the pages of the 'Register,' that I feel impelled to commence the discharge of this duty, without feeling certain, that I have any thing worth communicating. All must know that no one man could furnish all the original matter, which such a work ought to contain. And if the editor is willing to travel through the country, that he may the better qualify himself occasionally to treat his subscribers with such a repast, they certainly ought to endeavor to indemnify him, for the time lost from the labors of his pen, by writing as much as they can for him. We all feel, perhaps too sensibly, that we know but little worth communicating. But there is hardly one among the numerous subscribers, who does not know something valuable, which is unknown to a majority of the rest. This arises from the multifarious objects of agriculture, and the wide expanse over which these subscribers are spread. I know not by what rule the editor has been guided, in the direction of his excursions through the country. I presume, however, that he has sometimes been urged by other business than agriculture, but that, generally, he has gone where he could derive most information for his readers, with the least expenditure of time. Perhaps if he would visit those most, who furnish most for his pages, it might stimulate us to write much more than we have done. In that case, I know that the region in which I live, could have no right to expect him. But hoping that we will do better in future, I am electioneering for a visit with every word I write. True, it is not for me to set the value on the contribution. The editor has a perfect right to throw it in the fire, and it all goes for

nothing. In this, I am on a perfect equality with those who seek the favor of the sovereign people, and the candidates for the smiles of the fair. Love's labor may be lost; but I will be chivalrous enough to give notice to the other readers of the Register, that I have commenced my campaign, and hereby challenge competition. But, besides the inadequacy of what I may contribute, my chance for success is much marred, by the agricultural condition of the region in which I reside. The editor could glean but little hereabouts, worthy the imitation of others. He might, however, instruct us in better ways, excite us to greater and better directed exertions, and even were he to hold up our mismanagement as a beacon to others, I am sure it would be taken in good part. I believe that our section was once a fine one, and though perhaps as much damaged by the old fashions of agriculture, as any part of the state, with an industrious, moral, generous and frugal population, I trust it needs but a little stimulus and encouragement, and much instruction in agriculture—which would be joyfully received—to make it, in some measure, what it should be.

One of the most striking points in Mr. Sampson's management, appears to consist in the provision made for feeding stock, on his own farm. When Virginia was first settled, it is said, that from the luxuriance of pea-vines and other vegetation, a man on horse-back could not be seen, at the distance of ten steps, in the woods. Horses were ploughed all day, and received no other feeding than such as nature had placed in reach of their necks, through the night. They needed no shoeing, for a soft carpet was every where furnished for their feet, by the mould on the surface. This carpet is worn out, and much of the floor needs mending. There is necessity for proportion in every thing. By annually increasing our stock, and diminishing our woodlands, need was soon created for grazing our fields. These, by a scourging cultivation and much grazing and trampling, were soon killed dead, dead, dead—at least, most of them. And thus, was not only the yearly supply of cattle-food, which nature was affording, soon destroyed, but the stores of fertility which she had, for ages, been hoarding. Like the merchant who trusts out his whole capital, to bad debtors, we soon found ourselves frightfully embarrassed. The business was now to be carried on upon credit. It is one of *make-shifts* and expedients. The law of inclosures, permitting grazing on the commons, and in many neighborhoods, in common, enabled us, (while there was any grass in the commons,) to get along tolerably during the summer season. But, for the bitter suffering of stock in winter, I fear this state has much sin to answer for. Our cattle being compelled to subsist through the winter on the mere offal of the grain crops—corn tops, shucks and wheat straw—a meagre food at best—and often damaged by bad weather—could reach the spring season, with little besides skin and bones. The rule, in those days, and they have not past yet, with all of us, was, to attempt raising as many cattle as we could possibly drag through the winter. Within the last thirty or forty years, the proportion has been gradually changing. The majority of us, perhaps, now keep as many as we can sustain, on pasture, through the summer; finding that the offal of our grain crops will generally suffice in winter for this number. To this change of rule, we have not been led by judicious efforts at improvement, but by necessity. Most of the lands which were formerly turned out in commons, have been inclosed and converted to pasture, or again subjected to tillage; and the woodlands, instead of pea-vines, yield undergrowth and worthless weeds, and indeed, much of them have deteriorated almost as rapidly as the arable lands, from the trampling of animals, the blowing away of their leaves by the winds, and the evaporation, and, especially, by the washing off of their accumulated surface mould, by the rains. Moreover, Heaven—in mercy, as I believe—has sent the distemper among our cattle, which has swept off thousands, that might, otherwise, have died in a more lingering manner, and we thus have been compelled to keep fewer, than an improvident avarice might have dictated.

The individual who had the intelligence to devise, and the courage and energy to practise a good rule on this subject, deserves honor from his countrymen. The rule, as I would infer from the account, seems to be, to make ample provision for keeping as much stock, in good order, as the necessities of the farm require. This requisition, in this county, would amount to a sufficient supply of manure, of teams, of meat, wool, milk and butter. Of course, the demands of a very poor farm, for a sufficient supply of manure, could not, in the beginning, be expected to be satisfied. But the proprietor should be making as ample provision for it, as the nature of the case will admit. He should make every exertion to get as much of his land, as he can possibly spare from other crops, in grass, and other kinds of cattle food, with the assured expectation, of increasing the fertility of his land, and of course, its profits, in proportion to the increase of his manure. I allude only to such lands as have once been good. Those which were originally poor, will, of course, be more difficult to keep in good heart—without facilities for the application of lime. But we find that Mr. Sampson has improved poor land, by means of gypsum and putrescent manures. And, there is much land, which is not perceivably benefited by the application of gypsum, yet, I am led, by some experience, to believe, that after a slight application of ashes, all, at least in the central portions of the state, may be. I have not known plaster, when mixed with a little drawn ashes, to guard it against decomposition, to fail acting beneficially on corn, on any land.

Many persons, wilfully or ignorantly, misunderstanding the remarks made by the great 'Arator' on the system of inclosing, have entirely underrated the effects of animal manure. The English maxim, that "the more stocks, the more crops," cannot be expected to hold good, in this or any other country, where the stocks are permitted to remain constantly in a starving condition. But certainly, the larger the number of stocks, kept in good condition, the greater will be the facility afforded the managing farmer of making large crops.

The methods of management, suited to the agriculture of England, and those for Virginia, should vary much, in accommodation to the difference in the soil, climate, and circumstances of the two countries. But general principles remain the

same every where. Now, there is no principle, which appears to be more completely settled among the best English farmers, than that the more cattle there may be well fed on any farm, the more productive the arable parts of it may be made in crops. There must, however, in this matter, as in every well-managed concern, be held a just regard to proportion. It is, by no means intended, that nearly all the farm should be devoted to cattle-raising. The proper proportion must be settled by the discretion of each proprietor for himself. Were we to fix a general rule on the subject, we would say, aim to raise manure enough to supply each field once in every rotation. Of course, the quantity of land applied to raising cattle-food, would vary with the increase of fertility of the farm, and changes made in the size of the fields and the length of the rotations. By the way, much has been said about the proper rotation of crops, for this region; and here, also, it appears to me, that Mr. Sampson has discovered the true secret, that until the farm has reached its maximum fertility, the rotations should vary with circumstances. No rotation, however, will cause the majority of our fields to exert their highest capabilities, without the employment of animal manures. While there was a spontaneous production of cattle-food for nearly the whole year, many parts of the country were over-run with stock. And, though there was scarcely any trouble devoted to the spreading of manure, yet there was enough of it, accidentally distributed, to render our lands much more productive in wheat, than they have been recently. It is true, that of late years, the weather has been unpropitious to the wheat crop; and while much of the deficit in product may be ascribed to this cause, yet, from the fine crops occasionally afforded by well-manured lots, we may fairly infer, that the failure has, in a great measure, arisen from the great scarcity of animal manure. It has, for some years, been a matter of common observation, that a very slight top-dressing of this material will greatly increase the crop. And all of us have seen lands, rich in vegetable matter, yielding very poor returns in this crop.

Lime being unattainable in the central portions of the state, at a remunerative cost, there is probably no other means by which our lands can be restored to, and kept at, their primitive fertility, but by applications of animal, and indeed, of every species of procurable manure. To obtain a sufficient supply of animal manure, we must make it a special object to provide food in abundance for a suitable number of animals. This may be difficult, but it must be done, or the alternative is—farewell to old Virginia!

At the prices of meat, for some years past, it is somewhat questionable, whether, on the score of immediate profit, it might not be advisable to consume the provender at home, with a view of selling meat. It is admitted, that if all were to do this, meat would soon be much reduced in price. But who can calculate the comfort, and the profit too, accompanying the ability to supply all the mouths on a farm with an abundance of food? This might induce the necessity of greatly curtailing or abandoning the tobacco crop. But, if Mr. Sampson cannot afford to make tobacco, who can? It is also admitted, that this is, by no means, a good grass country. But if, through the instrumentality of grass, chiefly, we are to look for the means of creating and preserving the fertility of our lands, this should be the reason why our exertions to raise it should be greater. It is further admitted, that from the frequency of drought in summer, this is far from being a good turnip country. But the ruta baga will generally grow to a fine size, if sown on rich and well-prepared ground, by the middle of June. When sown much later than this, it commonly fails. The beet crop, also, requires early sowing. The young plants cannot thrive after the weather gets hot. The writer has some, sown the first of March, weighing twenty pounds, dry as the season has been; while his main crop, sown not until late in April, from inability to procure seed earlier, has been almost a total failure. These, and other root crops, with proper management, might be made important adjuncts to grass, in sustaining cattle.

Many persons have insuperable objections to grazing. Although it is believed by many others, that grazing may be so managed as to increase the producing qualities of the land in certain crops, yet the objectors may more rapidly improve, by a resort to soiling.

Most of the foregoing thoughts may be found in preceding numbers of the 'Register;' but the writer, considering the great importance of the subject, hopes to be pardoned, for so tediously urging it. While he would, by no means, depreciate all the other available means of improving, he trusts that the farmers of middle Virginia will seriously investigate the importance of carefully apportioning the number of their domestic animals, and the means of sustaining them, to the wants of their farms, in the way of manure. He hopes that the progress of internal improvement may develope new sources of deriving manure; yet he, perhaps, differs a little from the best authority, in believing that most of our lands are capable of attaining great fertility, from those already within our reach. The proper proportion between stocks and crops, and the beauty of system in the objects of agriculture, have been much deranged, by our local condition. The action of government—whether designedly, or not, is left to politicians—has also greatly tended to depress our agricultural prosperity. Evils often work their own cure. He must have been an inattentive observer, who has not noticed great changes in the state, within the last ten years. And he must have slight claims to a spirit of prophecy, who does not look forward to still greater changes. Agriculture may suffer for a while, but she has a versatility in resources, which, while she feeds the world, will enable her to serve up her table to her own convenience.

A leading motive to this communication, was to press the importance of more original matter in the 'Register.' It is hoped, there can be nothing amiss in stating, that to readers in this region, whatever comes from the pens of the writer in Philadelphia county, Pennsylvania, and of our own J. M. G., is particularly pleasing.

In conclusion, we would notice one obstacle to furnishing contributions to the pages of the 'Register,' better known, perhaps, to those who occasionally write, than to the editor. It is an unwillingness to tax him with postage. Perhaps this difficulty might be nearly removed, if some

friend in each of the towns, trading with Petersburg, were designated, who would receive and transmit to the editor, all communications that might be lodged with him. A better plan would be, for Congress to direct by law, that all letters directed to the editors of agricultural papers, should be transmitted free of postage. The patriotic vocation of these gentlemen fairly entitles them to such an immunity. The liberal-hearted old gentleman, often called "Uncle Sam," might exert his generosity much more unworthily. Should these remarks be honored by the perusal of a member of Congress, he would acquire the gratitude of at least one citizen, by attending to subject, and what is of vastly more importance, he might promote a cause, which has, not without reason, complained of inattention from "the powers that be."

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[Our correspondent has correctly guessed that the routes of nearly all the excursions of which notes have been published, were directed by the pressure of other business, more than by our own choice. It is very gratifying to learn that these crude and very defective notices have been approved by our present correspondent, and many others of our readers; and if so, of notes collected hastily, and irregularly, and almost under close constraint, it may readily be inferred that similar excursions, directed by choice, and conducted leisurely, and without distraction, would be very far more interesting and instructive. We have numerous readers and friends, (as well as subscribers) to the Farmers' Register, who sometimes have opportunities to make such excursions, and prepare better reports of their observations; and in no other way could they more effectually aid this journal to forward its great object, of serving agricultural interests. An excellent article of this general character, was commenced in the 7th No. and is concluded in this, of the notes of a corresdent taken during an excursion through western New York. Much instruction, as well as entertainment, would be furnished to our readers, by similar fruits of other journeys, made for pleasure, health, or business. If it were possible (which it certainly is not, unless effected by the action of government,) to obtain full and correct reports of the agriculture of Virginia, precisely as it is, with all its defects exposed, no less than its commendable features, the agricultural instruction that would thereby be conveyed, would be of incalculable value to the country.

If any communications have failed to be sent to the Farmers' Register, for fear of taxing us with postage, we beg that that obstacle may no longer be permitted to operate. It is true, that we *are* taxed both enormously and unjustly in postage—but it is not on communications; these we would be glad to obtain at far greater cost than the expense of postage. We have, however, felt the injurious operation of this tax, as a prohibition to that free intercourse by correspondence with the agriculturists of the country, which is all-important to the properly conducting of a journal devoted to agricultural interests. It is on this score, far more than for relief from the pecuniary tax of postage actually paid by editors of agricultural journals, that the plan of our correspondent, would be greatly beneficial.

But it is not only on the correspondence of agricultural editors that the prohibitory tax of postage operates severely. There is still a heavier payment, and a most unequal and unjust one, levied on the copies of our publication, compared to newspapers, and all such other publications as, by law, or by favor, are declared to be newspapers. This unjustice and hardship, under which this journal suffers peculiarly, is a subject, which we had before thought of exposing, however desperate might be the chance for redress. But its consideration is of sufficient importance to require a separate and substantive article—and we shall therefore refrain from giving our views in full, for the present.]

From the Northampton Courier.

MANUFACTURE OF PAPER.

The Northampton paper mill, has just commenced operations. It is on the old paper mill site, and is one of the most commodious buildings in the county. If the reader will follow we will lead him through the successive stages of the process, and show him how they manufacture an article, in the hands of every one, the manner of making which, is a sealed book to "the many." The first object of attention in the operations of the mill, is a gigantic overshot water wheel in the basement story—16 feet in length, and 20 feet in diameter. This drives the *engine* for grinding the pulp, the cost of which is nearly $3,000. The *paper machines*, are driven by a smaller tub wheel, the latter producing a more uniform and regular motion.

But few of our readers, we imagine, are aware of the beauty and simplicity of the processes undergone in the manufacture of paper by machinery. The rags after being sorted in the third story, are thoroughly dusted in a large revolving wire cylinder. From thence, they pass to the cutting machine, which reduces them to mere shreds. From this they are transferred to the engines in the second story, where, by the revolution of cutting rollers in large oblong tubs of water, they are in the course of a few hours converted into a fine homogeneous pulp. In these engines, also the pulp is bleached and changed from its original dusky hue, to a most pure and beautiful white.

From the engines, the pulp is now conducted below through troughs into cisterns of immense size, by which the machine is supplied. From one cistern, a thin stream of pulp is constantly flowing upon the machine, and by passing under a succession of rollers, comes out at the extremity of it in the form of paper—dry, and ready for use. As it issues from the cistern, it is received upon a horizontal moving sheet of the finest wire-gauze, having a quick, vibratory motion, which permits the water to strain through, but retains the body of pulp on its surface. It then passes under a solid iron roller, which acting with the pressure of more than a thousand pounds, forces out the water, and gives the pulp consistency, which consistency is further increased by the passage of the pulp under successive similar rollers. The paper is now made. But that it may be *dried*, it passes immediately from these rollers over and under several large hollow polished copper cylinders, whose

interior is heated by steam and being thus speedily and effectually dried, is received upon a reel, from which by machinery it is again immediately unwound and cut into sheets of uniform size, ready for use.

The machine just described, is called, from the name of its inventor, the "Fourdrinier Machine," and certainly in the whole range of the mechanic arts there does not exist a more beautiful or impressive example of the advantages resulting from the application of science to those arts. The whole process, from the time that the pulp leaves the cistern, until its formation into sheets of dry, finished paper, occupies *less than two minutes!* Whereas, under the old process of manufacture by hand, several days were required to accomplish a similar result. The cost of each of these machines is about $5,000. The paper is thrown off in a continuous sheet, and it may be manufactured to any length the manufacturer chooses.

VARIOUS SOILS OF ALABAMA.

To the Editor of the Farmers' Register.

I have just returned from a visit to that part of Alabama called the *Creek Nation*, and the southwestern part of Georgia. My business was to look at the country. The three counties that I examined in Alabama, present the greatest variety of soil that I ever saw—from the poorest to the richest, from the levelest to the most broken; but the greater variety is in the character of the soil, and, notwithstanding this great variety, it is all impregnated with lime to a greater or less extent. On the western side of the Chatahoochie, and immediately on the river, the lands are commonly rich—some places of a chocolate color, and at others, of an ash color. The river has high bluffs, and never overflows. The trees are stately and thick: this is called hammock land. The lands on the large creeks are somewhat of the same character, but are not so rich, it being a rare thing to find the chocolate lands on them. The lands on the Uchee and Big-swamp creeks, have generally a beautiful ash-colored soil, from six to ten inches deep, with a good clay under them. You will, however, on Big-swamp creek, find a good deal of mulatto or brown soil, mixed with isinglass; this I think the better land. The lands near the water courses are commonly hammock, and soon verge into hills and a broken poor country. This, however, does not hold good with the land on and between the waters of the branches of Big-swamp in that region. After you get out of the hammock, the land is gently undulating, with a scrubby post-oak growth, occasionally a short leaf pine, a hickory, and a white oak, with a beautiful loam soil from four to eight inches deep, supported by a strong yellow clay, which is considered preferable to the red for the growth of cotton. The lands, however, in the highest repute in this country, are the hammock lands on the Hacheehuby and Cowakee creeks; but I must beg leave to depart from that opinion for the reason that they have too much sand on the surface. There is a vegetable formation which has a beautiful loamy appearance; but on examining further down, there appears to be nothing but sand; and at the depth of from ten to sixteen feet, you come to a sandy clay, or, in other words, a clay having in it a considerable portion of grit. In this land, the *salamanders* work freely, and the hammocks in places are literally white with hillocks of sand thrown up by them; while other land within one hundred yards and having the same sightly growth will have a stiff steril, clay within one inch of the surface, and sometimes rising to the surface; this latter is called cow-hide land. The lands between those streams are generally poor and broken, some places very sandy, and at others, have a very thin vegetable mould, and under it, a stiff joint clay. The long moss grows plentifully on the trees through all this country. It is worthy of remark, that none of those waters overflow their banks—that the marl may be seen in the banks of those creeks, commencing from within eight to twelve feet of the surface, and the depth has not been ascertained; and it would take a man but a few minutes to gather a bushel of oyster shells out of the marl, by walking on the water's edge.

The above remarks have been hastily thrown together: they are, however, true, so far as facts are mentioned; and as I differ in opinion with many others, I am willing for my views to go for what they may be worth.

H.

From the Genesee Farmer.

MIGRATION OF BIRDS.

Passing a few weeks since along the margin of one of the smallest of that beautiful chain of lakes that form so remarkable a feature of the lake slope of western New York, and admiring the splendid rainbow colors of the autumn woods, reflected from its tranquil surface, we were greeted by the well-known cry of the loon, *colymbus glacialis*, several of which were floating within sight, their white breasts contrasting finely with the dark mirror-like color of the water, and the rich hues of the reflected woodlands. They had called to rest themselves for a few days, on their annual migration from the lakes of the far north to a more favored clime, and when overtaken by the chill blasts they had left behind, were ready at a moment's notice to resume their flight. "We shall have rain," said a respectable old gentleman whom we met a few minutes afterwards, "the loons are too musical for fair weather;" and his prediction was verified in a few hours.

Nuttall says—"far out to sea in winter, and in the great western lakes, particularly Huron and Michigan, in summer, I have often heard on a calm fine morning, the sad and wolfish call of the solitary loon, which like a dismal echo seems slowly to invade the ear and rising as it proceeds, dies away in the air. This boding sound to mariners, supposed to be indicative of a storm, may be heard sometimes for two or three miles, when the bird itself is invisible or reduced almost to a speck. The Indians, nearly as superstitious as sailors, dislike to hear the cry of the loon, considering the bird, from its shy and extraordinary habits, as a kind of super-natural being. By the Norwegians, its long drawn howl, is with more appearance of reason, supposed to portend rain." The loon has one peculiarity we have witnessed in no other bird, that of swimming, or flying under water, as it were, with the rapidity of an arrow, a feat we have often witnessed when the fine days of the

Indian summer seemed to invite all the birds that had lingered on their passage, to sports and pastimes.

The migration of birds is one of those extraordinary provisions of nature, depending for its accomplishment on what we, for want of a better name, are accustomed to call instinct; but which in many cases seems more like one direct and unerring emanation from the Deity, than the boasted reason of man. "When certain species of birds," says the Rev. Mr. Bachman, "at their first season of breeding, being without experience, build all their nests alike, both in form and materials, this may be called the result of instinct. On the other hand, when man guards against danger, or makes provision for the wants of life, or seeks relief from diseases, by the application of medicines, he acts from reason, because he is instructed by the experience of the past. When birds at certain seasons of the year, change the climate, in anticipation of heat or cold, they act from instinct, because, to many of them it is their first migration; and as they often migrate singly and not in flocks, in such cases no experience can aid them. On the other hand when man makes provision for the changes of season and climate, he acts from reason, and is instructed from his own experience or the experience of others."

A very large proportion of birds migrate, food or climate being usually the exciting causes, and this is particularly true of such as live or breed in northern latitudes. There are very few that are able to resist the cold and snows of our latitude, though birds have blood of a high temperature compared with man. Those that remain with us are mostly carnivorous, living on such animals as chance or the hunter may throw in their way; such as owls, hawks, ravens, the Canada jay, and the crow. Some remain that live on the buds of trees, as the partridge or grouse, the crossbills, and the grosbeaks; and a few of the smaller birds gain a precarious subsistence from the seeds scattered in barnyards, and from weeds rising through the snow. Two or three species of sparrow, familiarly denominated snow-birds, are of this class. But all the flycatchers, and warblers, those beautiful tenants of our groves and orchards, that feed on worms and insects; all the different families of the swallow, the night hawks, and whippoor-will, the tanager, and the oriole, early obey the wonderful instinct of nature, and seek in more favored climes the food denied them in this. They are followed by the divers, the snipes, wildgoose, ducks, the sand birds, in short all that frequent our waters and subsist on food from our fresh water ponds and rivers.

The habits of migratory birds were but imperfectly understood, until it was found that many kinds travelled mostly by night; and experiments made on the rapidity with which birds fly, and the time they are able to sustain themselves on the wing, have dispelled many of the errors which were formerly entertained on this subject. The wild pigeon of our forests, flies at the rate of a mile in a minute and a half, or forty miles in an hour, and his flight is continued by night as well as by day. This would enable him to pass from Georgia to our latitude in a few hours, and at a single flight; and hence the fact that geese, ducks, and pigeons have been taken in the northern states with undigested rice in their crops, which must have been gathered in the rice fields of the south. The swallow is able to fly twelve or fifteen hundred miles in twenty-four hours, and is thus enabled to reach his winter residence in Cuba or South America with ease. To avoid inconvenience during their night flights, birds fly much higher by night than by day; and almost every one has heard the hoarse notes of the night heron, or the harsh cart-wheel crake of the snipe, when high in the air: they were on their night migration. The great hooping crane can be occasionally heard during the day, as he passes without pausing over mountain and river, but at such a height as to be wholly invisible. We witnessed a curious illustration of the height at which the Canada goose sometimes flies, a year or two since. The night had been cold, with squalls. The morning was fair, with an occasional fleecy cloud at great height. About 9 o'clock the cry of wild geese was distinctly heard, but it was a long time before they could be seen, as against the blue sky they were invisible; at length a glimpse of them was caught against a white cloud like a row of small specks, and after they had passed through it, they were again seen with a glass. They had evidently lost their course during the night, and were seemingly unable to regain it, as they continued wheeling round through and over the clouds for nearly a quarter of an hour.

One of the most astonishing as well as pleasing facts connected with the migration of birds is the regularity with which they revisit their former breeding places, after an absence of several months, and a flight of thousands of miles. Birds marked so as to be known, have been observed to return to the same nest for many successive years, as the martin, swallow, bluebird, and wren. A phebe bird has been known to occupy the same arch of a bridge or the same cavern by the river for years; and it is very rarely indeed that the rights of the migratory birds are intruded upon, or they are obliged to expel usurpers from their former habitations. That welcome bird, the cliff swallow, so lately domesticated in the United States, the common barn swallow, and the chimney swallow, are found to return to their cluster of mud built nests, the barn, or the chimney they occupied the year before, with as much regularity, and certainty almost, as the seasons. The little song sparrow opens its song on the same hedge and builds in the same thicket of grass and leaves; and the meadow lark, and bobolink, wander as little as possible from their former breeding places. We greet them on their return, as old friends, and listen to songs that awake the remembrance of bygone years, and think as we hear their warbling —"what would this world be, without songs and flowers."

Closer and more extended observation has exploded the notion that some kinds of birds hybernate, or spend the winter, without migrating, in a torpid state. This was supposed to be the case with the rail or soree of Virginia and the barn and chimney swallows. The rail appears early in August in great numbers on the reedy shores of the southern Atlantic bays and rivers, and remains until October, when it disappears suddenly and completely, not an individual remaining where the day before they might be counted by thousands; and it was supposed they took refuge in the mud of the rivers. It is now ascertained they al-

ways migrate by night, which accounts for the suddenness of their appearance and disappearance. In our forests we sometimes find hollow trees nearly filled with feathers, bones and remains of decayed birds, and it was supposed that in these trees the chimney swallow lay in a state of torpidity through the winter season. It is now known, however, that these trees are the favorite resort or roosting places of these birds, while collecting for their migrations; the trees serving the purpose of chimneys in older countries. A few years since, a flock of these swallows collected for migration on Long Island, made their rendezvous in a chimney near Brooklyn, and being driven into a room below were captured to the number of several thousands. The bank or cliff swallow also collects in great numbers previous to migration, and these birds are so sensitive of cold, that sometimes before their arrangements are completed a premature frost will so benumb them that they may be taken in great quantities. The hint thus received is not disregarded: and about the time they disappear in the United States, they appear in the equatorial regions of America, where it is ascertained that they, in common with many other migratory birds, rear a second brood of young.

It sometimes happens that birds of delicate habits and very sensitive to a depression of temperature, return from their residence in the south before the state of the seasons in this latitude warrants such a movement, and the consequence is that numbers perish. In the year 1834, during the severe frost and snow of the 14th of May, numbers of the scarlet tanagers were picked up in the woods and fields, enticed from their winter homes by the previous warm weather; and last spring, after some fine warm weather in the same month, followed by a low temperature, we observed at one time some sixteen or eighteen of these birds, on the sunny side of a piece of woods, scarcely able to fly and evidently repenting their premature movement.

The changes in appearance which many birds undergo previous to migration must have been noticed by all. These occur in a striking manner in that familiar bird, the bobolink or meadow blackbird, as he is called in the north, or rice bunting of the south. At the time of their arrival from the south, and during the fore part of the year the male is easily distinguished by his sprightliness, his variegated and brilliant colors, and his spirited song. After the young make their appearance abroad, his song gradually ceases, his color fades, and before the period of migration arrives, he has assumed the brown sombre hue he wears through the winter, and in voice and appearance is with difficulty distinguished from the young or the females of the flock. Such is his appearance, when in countless thousands on the progress southward, they find food and rest in the rice fields of Carolina and Georgia.

There are some kinds of birds that perform their migration in such flocks as to be productive of serious injury to farmers by depredating on crops not housed and secured at the time. Late sown oats not unfrequently attract the blackbird in multitudes; and we have seen sad havoc made in the fields of golden corn by these same migratory hordes. The crow too, since its numbers have so greatly increased, is becoming seriously troublesome at the period of annual migration. It not only attacks the cornfield, or such grain as may be lingering in the fields, but plunders orchards of their sweet apples, and ravages the fields of new sown wheat. Immense flocks, almost rivalling those that during the winter congregate in the swamps and marshes of the Delaware bay and the eastern shore of Maryland, have this year shown themselves in various parts of the country, and wherever they have for a few days located themselves, they have done great damage in the ways enumerated. We have this year heard our farmers speak of their orchards in which every sweet apple was destroyed, and of their new sown wheat fields in which every uncovered grain was picked up, and the just sprouting ones gathered to such an extent that much injury it was feared in some instances would ensue. The distance to which the crow retires from our latitude is so limited, that a day or two of moderate weather and a south wind usually brings up more or less of them to feast on the animals that, during our winters, owing to the want of proper food or great negligence, perish in far too great numbers on our farms. It is indeed probable from their hardy habits, and carnivorous natures, that some of these birds do not leave the country at all, but during the most severe weather shelter themselves in the thickest pine or hemlock swamps.

Every one must be sensible of the pleasure he has experienced, when after our long and gloomy winters the approach of spring and summer is announced by the sweet song of the sparrow, and the familiar notes of the robin and bluebird. These birds are the earliest to show themselves with us, and announce that the stern dominion of winter has passed away. Later comes the tanagers and the oriole, the barn swallows and the other families of the fly catchers; but we can hardly deem ourselves secure from the sleet and snow, until the shrill twitter of the chimney swallow is heard nearly the first week in May, a gratifying proof that 'the winter is over and gone,' and that the labors of the husbandman may with safety be resumed. The song of the brown thrush, like the blossoming of the dog-wood, is by many considered as indicating the time to commence planting in the north, while in the south, the cry of the night hawk, serves, with the cotton and corn grower, to announce the proper period of commencing operations. Whatever justice there may be in these suppositions, it is clear that birds by their mysterious instinct appear to decide in most cases correctly on the weather; and that a knowledge of their habits, independently of the many sources of pleasure the pursuit opens to us, may be of essential use in the prosecution of agriculture.

REMARKS ON THE INJUSTICE AND ILL-POLICY OF THE HIGHER RATES OF POSTAGE CHARGED ON PERIODICAL MAGAZINES IN GENERAL, AND ON THE FARMERS' REGISTER, IN PARTICULAR.

A correspondent, for whose intelligence and judgment, we entertain very high respect, suggests (page 561,) the propriety and good policy of the correspondence of agricultural journals being permitted by law to pass through the mails, without being subjected to postage. Considering the proposition simply as affect-

ing the existing impediments to free communication of information, it is plain enough that such relief would be worth more to those journals, and to the agricultural interest, so far as they subserve that interest, than five-fold the amount of money now paid for postage by the publishers. There is not the slightest hope, however, of any such favor being conferred on agricultural journals; and for our part, we would be content if the work we publish, and other periodical magazines, could receive bare justice from the post-office law, and usage, by being made to pay no greater tax than other publications. We beg attention to the exposition which will be here offered of the grievance complained of, and its effects.

By the existing law of the United States, each newspaper is charged one cent per sheet postage, for carriage by mail, any distance within the state where it is printed—or to any distance without the state, not exceeding 100 miles from the place of publication. "When the mode of conveyance and the size of the mail will admit of it, such *magazines and pamphlets* as are published periodically MAY be transported in the mail, to subscribers, at one and a half cents the sheet, for any distance not exceeding 100 miles, and two and a half cents for any greater distance." (Section 39.) The rates, for these distances, on magazines and pamphlets not published periodically, are, respectively, four and six cents.

Pamphlets and magazines, to be executed as neatly as required for "book-work," must be printed on small sheets; the largest convenient size, under usual circumstances, being that used for the 'Farmers' Register.' Smaller sized sheets, would, of course, be charged so much the more, in proportion to size, for postage.

The 'Instructions to Postmasters' from the Postmaster General, define "a newspaper" to be "a printed paper, *giving an account of political and other occurrences*, published in numbers, *once a week or oftener*, and regularly." Under this interpretation, and by favor of the decision of the Postmaster General, (as is stated on every number of the publication,) the 'Cultivator' of New York has found shelter, and thus has been enabled to avoid at least half the tax of postage to which it would have been subjected as a monthly periodical, though issued in a single sheet of sixteen pages. We do not grudge our brother editor of the 'Cultivator' the benefit of this very liberal construction; but we may be pardoned for wishing that the 'Farmers' Register' had as much the favor of construction, as its postage would thereby be lessened some eight or nine hundred dollars a year.

The evident object of the law is especially to facilitate, by less charges, and give a preference to, the conveyance of newspapers—though their contents are principally advertisements of mere local interest—of political disputation, and party wrangles and calumny—and, but for the smaller part, of news, and other articles furnishing something to truly inform, or properly entertain, the minds of readers. It may be safely assumed, that, on an average, one-half of the amount of matter printed in every mailed newspaper, is of no interest whatever to the reader who receives it, and that one-half of the remainder is calculated to spread error, or foster evil passions—thus leaving, (and we believe it to be a very liberal allowance,) only one-fourth of the contents of each sheet to be of any value. It is to publications of this character, that the law gives a marked and unjust preference over magazines and periodicals—which may be useful, or worthless—entertaining, or dull—but of which the contents are at least free from the objections stated above to newspapers, and fully as much deserve the favor and bounty of government.

But, besides the difference of the rate of postage per sheet, between newspapers and periodical magazines, and the still greater difference caused by the far greater size of the former—there is yet another difference, in the universal usage, though an abuse of the law, in putting up and mailing newspapers as wet as they come from the printing press, and thereby having about one-third added to their dry weight. The 'Instructions,' it is true, (as well as the law) require that all "newspapers are to be well dried by the printers" before being wrapped for mailing—and that if the requisition be not complied with, the papers are to be returned to the printer, by the postmaster in whose office they are deposited for mailing. But these requisitions are never complied with, either by printer or postmaster; and it is notorious, that papers which are carried 500 miles in the mails, or more, are opened still quite damp.

The carriage of this additional weight of water, thus enclosed in every newspaper mail, is, by no means, its greatest evil. The wet packages rub against and injure each other, and also moisten, and then, in like manner, rub and injure the packages of magazines, which are necessarily dried perfectly before being wrapped; and in this manner is the greatest part of the damage in the mails caused, on routes where the contractors do not expose them to be soaked by rains and floods, as is the usage in the south and south-west.

It would be greatly to the advantage of printers themselves, if they were strictly compelled to obey the order to dry their papers. But unless obedience was general, there is no inducement for any one printer to dry his own, merely that they may absorb moisture from the other packages; and there would be caused, by that care, some delay, and much more trouble, in mailing his papers, both of which every printer is most solicitous to avoid. If any postmaster, in one of our large cities, were to attempt to obey this positive but obsolete instruction of the head of the department, he would bring the corps editorial, like a roused community of hornets, about his unlucky head; and the city which was the scene of action, would be thrown into a state of uproar and confusion, seldom surpassed by the excitement of the greatest political wrongs, or calamities.

Newspapers are received, either with or without limit as to number, free of postage by numerous functionaries of the government, including the 800 postmasters; and each of the publishers of all the newspapers in the United States, which it is said are not less than 1200, may receive by mail, free of postage, as many other newspapers as he chooses, in exchange for

his own. Why this exclusive privilege to private individuals, (which is so costly to the government, and so profitless to publishers of newspapers themselves,) should have been granted, it would be as difficult to answer satisfactorily, as to justify. No other periodicals enjoy any of these privileges of free carriage, in any case; and yet if governmental favor is to be thus given, and the pretext be, to spread useful knowledge and instruction, surely the contents of some other journals deserve favor on that score, at least as much as political newspapers. If the number of newspapers published be 1200, and each, on the average, exchanges for only fifty others, (and some exchange for several hundreds,) and those, exchanged for, average a tri-weekly issue—then the whole number sent free of postage to editors, and as a discriminating bounty to the trade of publishing newspapers, will amount in number to 180,000 exchange papers sent by mail, mail, weekly, through the United States; and the average (wet) weight of this weekly freight would not be less than 16,000 lbs. Now, as the whole expense of the post-office department is borne by its income, or, in other words, is paid by the whole amount of postages received, (and does not, and ought not to receive any thing more than is necessary to pay the expenses—) then the gratuitous carriage given to exchange and other newspapers, is afforded by the government, at the expense, and to the disadvantage, of all others paying postage—and the heaviest, as we shall more fully show, is imposed on magazines—the publishers of which, therefore, are not only debarred from equal favor with their brethren, but are made to pay a large proportion (in the tax on their publications,) of the bounty given to newspaper publishers.

For the purpose of ascertaining more precisely the inequality of the burdens of postage, we compared, by carefully weighing, a newspaper of the largest size, taken at hazard, (it was a copy of the 'Journal of Commerce,' of New York, for the country,) a copy of the 'Cultivator,' and a number of the 'Farmers' Register.'

Largest sized newspaper, weight of sheet, dry, - - -	33	*dwt.*
Same, made as wet as usual, when mailed,	46	"
'Cultivator,' weight of sheet, dry, -	19	"
ditto wet, -	26	"
'Farmers' Register,' four sheets and cover, 72½ *dwt.* or one-fourth of that amount to the sheet, - - -	18⅛	"

Then, comparing the rate of postage of each with its weight, as mailed:

The newspaper, sent to any place in the state of New York, or without the state, if not farther than 100 miles from the city, pays, on every weight of 46 *dwt.*, -	1 cent.
The 'Cultivator,' pays in like manner, for an equal weight, 46 *dwt.*, - -	1⅝ cents.
The 'Farmers' Register,' over 100 miles, and whether in or out of Virginia, on the same weight, 46 *dwt.*, - -	6 cents,

within a very small fraction.

Thus, for the distance that nearly all the copies of the 'Farmers' Register' are mailed, and for those which it is supposed the other named publications are also mostly sent by mail, the proportion of payments stand thus. The 'Farmers' Register' pays, in proportion to their respective weights, more than thrice the postage of the 'Cultivator,' (charged as a newspaper) and six times as much as the largest sized newspapers.

After these experiments, and to bring the matter to the test of practice and usage, we weighed 32 newspapers, at the nearest office, taken together, and while they were in the course of being directed, and put up for the mail. They were believed to be then *fully* as dry, if not more so, than those of all large establishments usually are, when mailed. These 32 papers, (imperial size) weighed, wet, 45½ oz. avoirdupois, and when dried, only 34 oz., or less by 11½ oz. This difference of weight, (or proportion of water) is a very little less than in the two preceding experiments.

Again. The average annual postage paid by the subscribers for the 'Farmers' Register,' amounts to fully $1700, and the total cost of paper used to print the same number of copies, is only $800, or less than half that sum—an amount less than half the tax paid to government afterwards, for the carriage alone, by the subscribers. The slightest consideration of these facts will show, that this tax, discriminating and prohibitory in its operation, is enormous, both in its amount, and in its injustice—and that on every score, of policy no less than justice, the grievance calls loudly for legislative reform.

There are but few agricultural publications in the United States, in the magazine form, and therefore subject to this very unjust rate of postage. The greater number have assumed the much cheaper sheet form, so as to come under the newspaper indirect bounty.

If no other consideration should operate to prompt a change, there would be enough inducement in the advantage, in prospect, to the revenue of the post office department. The changes called for, are these:

1. To compel the execution of the existing law, as to drying all papers before their being mailed.

2. To charge the postage on all publications conveyed by mail, according to their *average weight*, instead of by the sheet—and to permit no difference in charge, in favor of newspapers.

3. To put down the system of exchange newspapers being sent free of postage.

4. To have, on all important routes, a *slow mail*, to convey whatever may be committed to it in preference, at a lower rate, than where the usual expedition of conveyance is given.

This last plan would be a far greater benefit to the people, and to the government, than the *express mail*, made faster than the ordinary mail. The existing rates of postage are not too high on the present system; as it seems no surplus is left after defraying the expenses; the greatest objection to them, is their inequality. If equalized, as justice requires, there might be no general or considerable reduction, nor can that be, while the expenses remain the same. But if the greater part of the weight of the mails were carried as

slowly as fifty miles a day, by horses, (which, by relays, would travel that distance in a walk in twenty-four hours)—and on railways and in steamers, as ordinary freight, by not demanding particular hours of departure, or speed—it is manifest that a far greater profit might be made by carrying the freight at half the postage charged for the present mail expedition, and punctuality of arrival. By this slow mail would be sent all periodical publications of which very rapid transportation is not so important as cheapness, and security from loss and injury on the passage. The expense of contracts for carriage in the modes proposed, need not exceed triple the ordinary freight of wagons, railways, or steam vessels. In this manner, (added to the excluding wet papers,) the fast mail might be lightened by one-half, and kept at a more regular size, by throwing all congressional documents and such irregular luggage into the slow mail. They would still travel fast enough to serve their main, if not sole purpose—that of electioneering.

One of the reforms proposed above, is to abolish the franking of exchanged newspapers—and it was intimated, that the privilege, as it exists, is of little service, even to the publishers of newspapers themselves. If it is a benefit to any, it is to the small low-priced and ephemeral papers, which are established on the most pitiful footing—which are generally unprofitable to their undertakers, and seldom fail to lead them from poverty to acknowledged bankruptcy—and, (if in the country, or small villages,) while they live, are worthless as public journals, but fruitful sources of calumny and mischief, in their otherwise quiet neighborhoods. Such nuisances as these, and all other infant and weak newspaper publications, receive a bounty from government, in their franked exchanged papers, as they thus get a part of their necessary capital free of cost. But if the great majority of those new, low-priced, and inferior newspapers, are not actually injurious, in the general, to the public, and a loss to their proprietors—their establishment is certainly a greater injury, (by dividing and withdrawing patronage) to existing and really valuable newspapers, than is repaid by all that the latter class gain by being relieved of postage on all the exchange papers they would care to receive. Besides, the desire to oblige applicants, and various other considerations, induce the publishers of the most valuable papers to extend their exchanges to numerous inferior papers which they do not want, and seldom even glance at. The carriage of all this superfluous burden, is a dead loss to all concerned. Now if exchanges, free of postage, were not suffered by law, the publishers of the most valued papers would reduce the number of their exchanges greatly in number, without losing any thing of worth, and be relieved from much injurious competition.

The whole tax of postage imposed unjustly and without necessity on periodical magazines, is, to its extent, prohibitory to their publication. The excess of tax of postage paid on the 'Farmers' Register,' over and above what would leave the government equal profit, on a reformed and improved system, cannot be less than $1200 a year. The exaction of this sum operates as so much impediment or prohibition to its circulation—and is, so far, an injury to the agriculturai interest, without any comparative advantage to the government. The magnitude of the injury thus inflicted, is sufficient to serve us as an excuse for offering these remarks; and for respectfully requesting for them the attention of members of the Congress of the United States.

If the carriage of letters and periodical publications were open to private enterprise and competition, there is no doubt but that it could be effected, on all the principal or important routes, much cheaper than for the postage now paid thereon. But government possesses and exercises a close monopoly of all this great busiuess; and all effective private competition is forbidden by heavy penalties. This is not to be objected to, inasmuch as this monopoly, with its profits, is necessary to be maintained, to enable the benefits of mail carriage to be afforded to the routes and localities giving little business and no profit to the post office department. But on the other hand, in return for this monopoly, (a kind of privilege always odious in itself, and which never should be exercised by any power, without good reasons,) the government owes it to the payers, that mail carriage should be afforded as cheaply as may be done without lessening the nett income of the department. Hence, the equity of the claim for a cheaper and slower mail, in addition to the reasons on the ground of expediency.

There is another kindred subject, well deserving the consideration of the government, in the enormous losses caused to all publishers of newspapers and magazines sent by mail, and also to the post office department, by the gross neglect of many postmasters of existing regulations. On this subject we may offer some remarks at another time.

COMMERCIAL REPORT.

An active business has been done in Virginia, during the last two months. The moderate extent of importations, enabled merchants to sell their stock of goods. Confidence is, in a great measure restored, and notwithstanding the heavy losses, which were sustained by the almost unparallelled reverses in the great commercial cities of London, Liverpool, New York, and New Orleans, with which many of our merchants have intimate connections, few failures have occurred in Virginia, and the regular course of trade is almost resumed.

Tobacco commands good prices; the crop of 1836, proved small, and that of the present year is considered moderate. The quotations are $3 to $8—embracing all qualities. A large portion of the Kentucky crop of 1836, was not carried to market, and the extremely low price caused the cultivation to be diminished this year. Still, the aggregate of the old and new crops, will afford an unusually large supply.

Cotton has not varied much in price, since the new crop began to appear; the early receipts commanded 11 cents, and the immediate wants of northern manufactures being supplied, the price has gradually declined to 10 cents for good quality; it is exported nearly as fast as it is brought to market. The crop of the United States, is es-

timated to be very large, and including the stock of old, which remained in the interior, the lowest estimate is 1,600,000 bales. An increased consumption of American cotton will be required to absorb so large a quantity, and this can only be attained by low prices, and a resumption of regular commerce—one item of which is importations of goods into this country, which have been suspended since May last.

The price of wheat advanced in November to $2 to $2 10 per bushel, and of flour to $9 to $9 50, under an expectation that the closing of the New York canals, would deprive the northern and eastern states of an adequate supply for the winter; but the weather continued mild until within the last few days, and the vast granary of the Genesee country was emptied into the city of New York. The price of wheat, has consequently, declined 25 to 30 cents, and of flour about $1. Large importations of wheat from Europe are expected. It may not be uninteresting to record the receipts at New York, of the principal articles of produce, brought down the Hudson during the continuance of navigation this year.

1837	Bbls. flour.	Bbls. pot and pearl ashes.	Bbls. liquor.	Bbls. Provision.	Cakes and boxes cheese.	Kegs and tubs butter.
April,	17.196	2.747	727	3.434	228	572
May,	20.530	2.907	677	3.527	235	581
June,	27.188	4.171	1.419	3.244	573	741
July,	52.547	10.489	3.570	3.635	3.258	2.314
August,	30.786	7.541	2.130	11.614	3.978	3.675
September,	62.612	2.320	689	4.437	5.071	2.147
October,	148.856	2.558	575	3.191	10.358	8.454
November,	246.175	3.098	1.936	6.370	5.201	6.530
Dec. 8th,	45.964	1.980	668	3.862	1.580	1.828
	651.854	37.811	12.391	43.314	30.482	26.862

This exhibits the glorious result of well-directed enterprise! May Virginia at a day, not very remote, be able to show something like it!

Provisions have fallen in price. Pork sells at $6 per cwt. On the Ohio it is quoted as low as $3 a $3 50 per cwt.

Internal exchanges are not yet restored. Between the western and Atlantic states the difference is 5, 10 and even 15 per cent.; bills on England have declined to 11 per cent.; so that the resumption of specie payments is probably not very remote. A convention of bank delegates, was recently held in the New York, for purpose of fixing a day; but it adjourned to meet again in April next, when there is no doubt, the object will be accomplished, by general consent, if specie payments be not sooner resumed by the voluntary action of the banks.

X.

December 16, 1837.

ACCOUNTS, AND CREDITS FOR COLLECTINS.

From some answers to bills recently sent to all subscribers who stood charged *for more than one volume*, we find that some had been surprised, and others offended, that such bills should have been received, *after* they had, at some short time previous, made payments to a collecting agent. If subscribers would but consider that returns from agents cannot often be made immediately, (and of course, their receipts are not sooner known and credited) the true cause of what are incorrectly supposed to be errors in our accounts would be readily inferred—and the regular annual presentation of bills, by mail, after such recent payments, would furnish ground neither for surprise or displeasure.—Ed. Far. Reg.

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